Tilburg University

Customer relationship management through business intelligence

Sturdy, G.

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

Link to publication in Tilburg University Research Portal

Citation for published version (APA):
Sturdy, G. (2013). *Customer relationship management through business intelligence*. [s.n.].

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 06. May. 2023

UNIVERSITEIT

VAN TILBURG

Customer Relationship Management

Through Business Intelligence

Proefschrift

ter verkrijging van de graad van doctor aan Tilburg University op gezag van de rector magnificus, prof. dr. Ph. Eijlander, in het openbaar te verdedigen ten overstaan van een door het college voor promoties aangewezen commissie in de Ruth First zaal van de Universiteit op

maandag 2 december 2013 om 16.15 uur

door

Graham Sturdy
geboren op 3 januari 1952 te Dublin, Ierland

Promotor:
Prof. dr. J.B. Rijsman

Copromotor:
Dr. J. Roevens

Overige commissieleden:
Prof. dr. H. Hendrickx
Prof. dr. W. de Ridder
Dr. M. O'hAodha
Dr. M. van Gastel

DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of PhD, is entirely my own work and has not been taken from the work of others, save as and to the extent that such work has been cited and acknowledged within the text of my work.

Name of Candidate: Graham Sturdy

Signature of Student: *Graham Sturdy*

Date: 15th October 2013

GRAHAM STURDY

ACKNOWLEDGEMENTS

I would like to express my appreciation to Dr John Rijsman, and Dr Joseph Roevens for providing the opportunity to participate in the Doctoral programme. I would like to thank Dr Marc van Gastel, for his encouragement, great attention to detail, and his support and patience during the formulation of this thesis, and also Professor Hendrickx, Professor de Ridder, and Dr Mícheál Ó hAodha, for their analysis and critique of the dissertation. I would also like to express my gratitude to Professor Eamonn Murphy of the ERC in Limerick, for so generously providing research facilities; to Dr Jose Esteves, Dr Ingrid Hunt, and especially to Dr Maeve Fitzpatrick, whose advice to do what *"floats your boat"* proved to be invaluable. A special thanks also, to mentors and tutors, who provided invaluable assistance along the way, in particular Dr Finn Janning, and Jan Vanherck.

Other people, who I would like to thank, include; Carla De Jong, Robin Rowley, Norman Sturdy, George Sturdy, Pat Lyons, Pat Nash, Pat Cuneen, Eamon Ryan, and Tom Finucane, who all provided varying degrees of support and assistance, which greatly assisted with different aspects of my research efforts.

I would also like to take this opportunity to thank everyone else who has helped me with other aspects of the programme, including my fellow students and the course facilitators for their contributions throughout the length of the programme.

To all of the above and to everyone else who shared this journey with me, I would like to borrow a few words from Oscar Wilde:

Yet each man kills the thing he loves,
By each let this be heard,
Some do it with a bitter look,
Some with a flattering word,
The coward does it with a kiss,
The brave man with a sword!

…Oscar Wilde.

DEDICATION

To the few that matter the most; Salena, Neil and Graham

ABSTRACT

The ability to extract and present information in a meaningful way is vital within the organisational context. Enterprise systems have become essential tools for the support of strategic initiatives and organisational activities, which greatly assist in aligning their competitive strategy towards their key objectives. Where, once these tools remained in the preserve of large organisations, they are now being increasingly adopted by smaller organisations and enterprises. In the face of shrinking markets, Business Intelligence (BI) vendors are now targeting smaller organisations. However, many programmes fail due to poor planning, lack of resources, organisational immaturity and failure to understand the complexities of integrating such applications within the existing business structure. This study examines the implementation of an Enterprise Resource Planning (ERP) tool within a retail outlet chain located in Belgium. It then goes on to examine how a BI solution was developed, to improve the availability of operational and strategic planning information by harnessing the large amounts of data which could be accessed through the combined ERP and BI systems.

With ever-increasing competition and rapidly changing customer needs and technologies, enterprise decision makers are looking for new ways to view and evaluate key performance indicators. The trend now, is for random, and spur of the moment queries to be answered quickly, and the provision of actionable information from analytic applications using real-time business performance data. Both ERP and BI tools are discussed from the perspective of selection, integration strategies and delivery platforms best suited to the organisation under discussion. The case study demonstrates how a highly effective BI solution was built on top of an ERP Implementation, in order to; track customer behaviour, improve services and relationships, in order to gain a sustainable competitive advantage.

Within the analysis section of the thesis, the author presents "A BI Psychology Adoption Model" which represents new and innovative thinking in relation to how employees within organisations react to the introduction of new technology within the workplace.

LIST OF ABBREVIATIONS

ABC	Activity Based Costing
AET	Affective Events Theory
AI	Application Integration
APS	Advanced Planning and Scheduling
ASAP	Accelerated SAP Methodology
B2B	Business to Business
BI	Business Intelligence
BCG	Boston Consulting Group
BIM	Business Intelligence Management
BIS	Business Intelligence System
BPR	Business Process Reengineering
CEO	Chief Executive Officer
CIO	Chief Information Officer
CORBA	Common Object Request Broker Architecture
COO	Chief Operations Officer
COTS	Commercial off The Shelf Software
CPFR	Collaborative Planning, Forecasting and Replenishment
CRM	Customer Relationship Management
CSF	Critical Success Factors
CTO	Chief Technology Officer
DAS	Digital Advertising Displays
DBMS	Data Base Management Systems
DM	Data Mining
DSS	Decision Support Systems
DW	Data Warehouse
EAI	Enterprise Application Integration
EDI	Electronic Data Interchange
EDW	Enterprise Data Warehouse
EIS	Enterprise IS

EPT	Electronic Price Tags
ERP	Enterprise Resource Planning
ES	Enterprise System
ETL	Extract Transform and Load
EWS	Enterprise Wide System
GIS	Geographic IS
GPS	Global Positioning System
GQM	Goals/Questions/Metrics
GSM	Grand Strategy Matrix
GT	Grounded Theory
GUI	Graphical User Interface
HEI	Higher Education Institution
ICT	Information and Communications Technology
IE	Internal External
IO	Industrial Organisations
I/O	Industrial Organisational
IS	Information System/s
IT	Information Technology
JIT	Just In Time
KPI	Key Performance Indicators
LAN	Local Area Network
MCP	Most Critical Processes
MES	Manufacturing Execution Systems
MRP	Material Requirements Planning
MRPII	Manufacturing Resource Planning
MS	Master Schedule
NM	Neuromarketing
OLAP	Online Analytical Processing
OLTP	Online Transaction Processing
PIR	Post Implementation Review
POS	Point Of Sale
PQM	Process Quality Management
PSA	Personal Shopping Assistant
RBV	Resource Based View

RDBMS	Relational Database Management Systems
RFID	Radio Frequency Identification
RFT	Regulatory Focus Theory
RFT	Radio Frequency Technology
ROA	Return on Assets
ROI	Return on Investment
SCM	Supply Chain Management
SME	Small and Medium Enterprise
SPACE	Strategic Position and Action Evaluation
SOLAP	Spatial OLAP
SQL	Structured Query Language
SWOT	Strength Weakness Opportunities and Threats
TAM	Technology Acceptance Model
TMS	Transportation Management Systems
TQM	Total Quality Management
UPC	Universal Product Scanning
VMI	Vendor Managed Inventory
VPN	Virtual Private Network
WMS	Warehouse Management Systems

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter One

Introduction

"The greatest composer does not sit down to work because he is inspired, but becomes inspired because he is working." - Ernest Newman

This chapter introduces the doctoral research project, providing an outline of why the research has been undertaken, placing it in context and demonstrating its importance. To start, an overview of both Enterprise Resource Planning (ERP), and Business Intelligence (BI) systems, is provided, along with an analysis of their different perspectives and contributions within the organisational framework. Then, the research questions are outlined and an overview of the eight chapters within the thesis is presented.

Within today's competitive environment, many organisations are recognising the need to present a single face to global customers, to respond rapidly to customer demands, and to seek out economies of scale. In this context, the capabilities offered by Information Technology (IT) are being re-examined, leading many organisations to evaluate the feasibility of installing ERP systems. ERP's are usually installed in order to replace a firm's existing diverse transaction processing systems, with an integrated system that embodies the concept of tight interdependencies among a firm's functional units. From a top level perspective the stages involved in ERP implementation are:

1. Design.
2. Implementation.
3. Stabilisation.
4. Continuous improvement.
5. Transformation.

These stages as they relate to organisational performance are illustrated in Figure 1 below. ERP's have the potential to revitalise IT infrastructures and enable global business process integration however, implementation of these planning systems has proven to be very expensive in some instances, and the rewards for implementation can, at times be difficult to define.

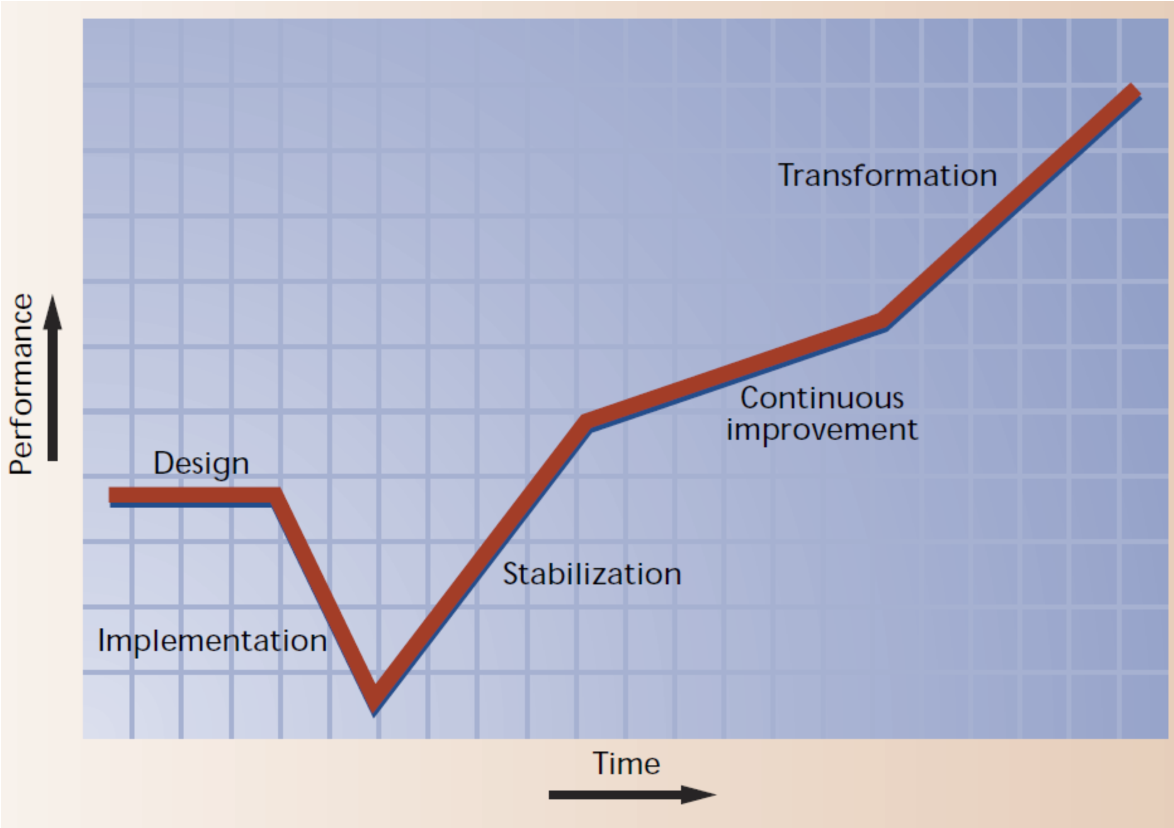


Figure 1: ERP Stages. *Source: (Ross and Vitale, 2000)*

This model which was developed by (Ross, 1999a), is based upon 15 case studies of ERP implementation. The design phase is essentially a planning phase in which the critical guidelines and decision making for the implementation are determined. The implementation model includes a number of aspects of the (Bancroft, 1996) phases, such as*; "AS-IS", "TO-BE"*, along with the construction, testing and actual implementation of the model. For Ross, stabilisation occurs during the implementation stage, in which system problems and issues are addressed and then resolved, and as a result, organisational performance consequently improves. This is followed by a continuous period of steady improvement in which functionality is added. Eventually, the expectation is to reach the stage of transformation in which organisational boundaries and systems are fully coordinated.

For many organisations the challenge that is presented in implementing ERP systems is not the introduction of a new system, nor is it due to the simple fact of change. The real challenge arises out of the fact that ERP implementations necessitate a level of disciple within organisations that may not have existed within the organisation up until that point in time. In order for the organisation to achieve the level of discipline required, the level of organisational change required can be quite considerable, and not without its challenges, and it can often be the fact that in the initial stages of transformation, that the change that is brought about, does not immediately look like an improvement to many employees. This means that for many managers, the installation of ERP systems involves much more than addressing the technical obstacles to ERP implementation. The goal of an ERP implementation should be to lead to a new organisational reality, which is characterised by an increased emphasis on process and strategic vendor alliances. Within this context the focus on organisational change requires a high level of managerial skill, along with the technical and process expertise that will allow for a constant reassessment of organisational processes and the systems they depend upon.

1.1. Technological Change

Information Technology has changed both social and economic structures and its development has offered various opportunities for innovative business concepts to emerge. Nearly 40 years ago, Intel co-founder Gordon Moore forecast the rapid pace of technology innovation. His prediction, popularly known as *"Moore's Law"* states that transistor density on integrated circuits doubles about every two years. This is brought about, as the scale of integrated devices gets smaller and smaller. The current state of the technology allows for the printing of individual features smaller than a virus and 1,000 times thinner than a human hair and the manufacturing of microprocessors with features as thin as five atomic layers. Commercially available microprocessors now contain billions of transistors, which means that the real cost of processing power has shrunk by many orders of magnitude since Moore first made his prediction. Hard disk drives were invented in the 1950s by IBM. They started as large disks up to 20 inches in diameter holding just a few megabytes. But it wasn't until the middle of the 1980s that people began to use hard disks in more standard PC's, and since then development has surged ahead. Komorowski has researched the relationship between hard drive storage and cost. Figure 2 illustrates the very strong exponential correlation in the space/cost ratio of hard drives over the last 30 years, beginning in 1980 during which the space per unit cost of a typical hard drive has doubled approximately every 14 months, demonstrating an order of magnitude increase every 48 months. The strong correlation is confirmed by the R^2 value of 0.9812. Today, the hard drive is found everywhere, from the PC's that we use daily to MP3 players and memory sticks. A similar decline has been noted in the cost of data warehousing, whereas the average warehousing budget was in the region of $2 million about 10 years ago, this is now much closer to $1 million today. These costs continue to decline as computing power and capacity increases, and storage technologies become cheaper and faster.

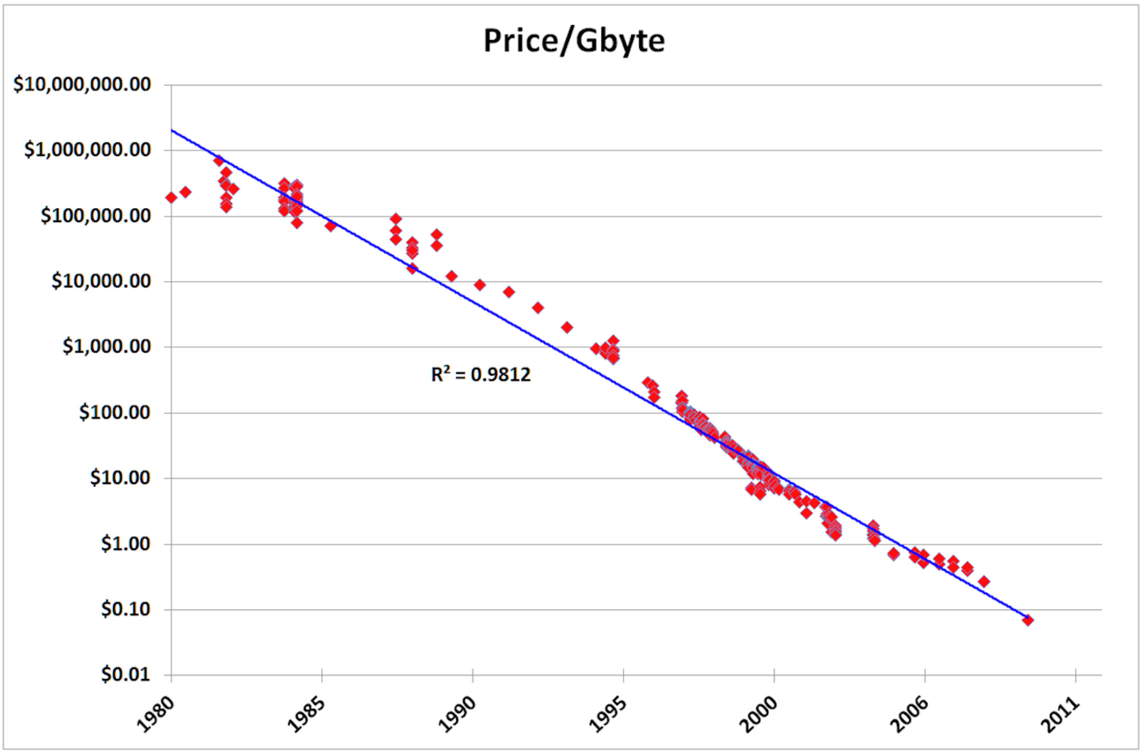


Figure 2: Hard Drive Cost per Gigabyte 1980 – 2010. *Source: (Komorowski 2010)*

Over the same time frame marketing research in retail settings has also undergone a radical transformation, and Information Technologies, have played a major role in enabling this transformation to occur. This has occurred in what (Schiller, 1987), has described as a set of *"waves"*. The first wave was led by the big superstore operators, and this can be traced back to the early 1970s. This was followed by the second wave, which started around a decade later, and featured increasingly sophisticated retail warehouse operations. The third wave centred on the area of comparison shopping. The first wave of change occurred when retailers adopted Point-of-Sale (POS) systems with Universal Product Scanning (UPC) barcode scanning. This gave companies the ability to track real-time data on purchase transactions and also provided accurate estimates of product sales and market share. Retailers used this information to measure the productivity of their operations. By modelling the data as a function of variables, such as product price, display activities, and feature advertising, marketers were able to assess the performance and profitability of their marketing investments (Blattberg and Neslin, 1990). Scanner data is in widespread use today and is used to support many critical business decisions. The second wave of change came about as a result of retailers starting to track and analyse the purchases of individual shoppers. A number of retailers, especially in the grocery industry, launched frequent shopper and customer loyalty programmes to collect these data. Shoppers who participate in such programmes typically identify themselves with loyalty cards at the point of sale in exchange for price discounts or other incentives. Companies can also identify repeat customers by requesting their telephone numbers, capturing information from credit and debit cards, and by the placing and reading of *"cookies"* which have been stored on their computer disk drives. This information is often combined with geo-demographic and behavioural data from other public and private sources to create a profile and purchase history for each customer or household. These data can be used to estimate customer value and loyalty, measure individual-level response to direct mail and other targeted promotions, and conduct shopping basket analyses to identify product complementarities among other applications (Berson and Smith, 2002). The technology have now entered and, is well into the third wave of change, there are even those who talk about an emerging fourth wave, which embraces warehouse clubs, factory outlet centres and airport retailing (Fernie, 1995).

Within the third wave, the technology drivers are the digital representation of the shopping environment and the real-time tracking of customers as they enter the retail outlet, walk through the various sections, and select and purchase products. Like the earlier innovations, it provides the capability to capture variations in consumer behaviour over time and across people, but it adds to the mix the critical element of context. This new wave of marketing intelligence provides marketers with the tools to measure consumer response to the in-store environment, and manage the shopping process. It is the foundation for customer experience management (Burke, 2010). Table 1 demonstrates how every generation of marketing intelligence has enhanced the overall understanding of how marketing, customer, and environmental factors affect consumer behaviour and retail outlet performance. The increased focus on the shopping process has fuelled two recent trends in retailing research. The first is the increased use of observational and ethnographic research (Underhill, 2008). The second trend in retailing research is the increased use of computer hardware and software tools to track customer behaviour in both online and conventional retail shopping environments. Unlike traditional ethnographic research, which can be very time consuming and subjective, computer tracking provides an efficient and reliable means of collecting and analysing data on the consumer shopping process.

	Wave I	**Wave II**	**Wave III**
	Brand and category management	*Customer relationship management*	*Customer experience management*
Enabling technologies	UPC barcode scanning	Customer loyalty cards, credit/debit cards	Real-time customer tracking (RFID, GPS, video, clickstream, portable shopping devices)
Causal variables	Product assortment Shelf space Price Promotions Displays Feature advertising	Wave I, plus: Customer attributes (geo-demographics) Purchase history Targeted promotion	Wave II, plus: Store layout Store atmosphere Navigational aids Product adjacencies Service levels Queues/crowding In-store events
Performance measures	Sales Market share Gross margin Sales/square foot Turn rate GMROII	Customer retention Customer loyalty Share of customer Lifetime value ROC curves	Store traffic Shopping path Aisle penetration Dwell time Product interaction Conversion rate

Table 1: The Evolution of Marketing Intelligence. *Source: (Burke, 2010)*

1.2. Motivation and Research Objective

This Doctoral Thesis provides a greater understanding of how organisations can implement a combination of strategic management techniques from both an internal and external perspective in order to gain a sustained competitive advantage. It shall be demonstrated how the implementation of an ERP system can greatly enhance the internal capabilities of an organisation through the use of the Resource-Based View (RBV) framework. Having put in place the framework to allow for strategic advantage through its internal capabilities, it will then be demonstrated how this capability was then built upon to enhance the availability of both operational, and strategic planning information, in order to extend the strategic capabilities into the external environment through the use of Business Intelligence Management (BIM) techniques. The synergy created by the implementation of these two systems provided the springboard to allow for the creation of a more complete Customer Relationship Management (CRM) model. Sustainable competitive advantage results from operational effectiveness, which comes about as a result of doing what your competitors do, but better, or strategic positioning, which delivers a unique value to customers by doing things differently than your competitors (Porter, 2001b). The main thrust and arguments within the thesis centre on, the ability of BI to offer a strategic competitive advantage within organisations, with the emphasis on Information Systems (IS) that enhance strategic decision-making, that support the competitive strategy of an organisation (Wiseman, 1988). BI, termed in French as *"veille strategique"*, is considered as; a systematic approach by which a company keeps itself vigilant and aware of developments and early warning signs in its external environment in order to anticipate business opportunities or threats. The external environment includes all factors and events outside the company that can affect its performance (Rouibah and Ould-ali, 2002). In relation to strategic management, there is a divergence of opinion within the literature as to whether, the internal audit, or the audit of the external environment should receive more emphasis. Proponents of the Industrial Organisational (I/O) approach to competitive advantage advocate that external factors are more important than internal factors for a firm striving to achieve competitive advantage. Scholars of the I/O view, such as Michael Porter, contend that organisational performance will be primarily determined by industry forces (David, 2011a). Porter's Five-Forces Model, illustrated in Figure 3 is an example of the I/O perspective, which focuses upon analysing external forces and industry variables as a basis for getting and keeping competitive advantage. Competitive advantage is determined largely by competitive positioning within an industry, according to I/O advocates.

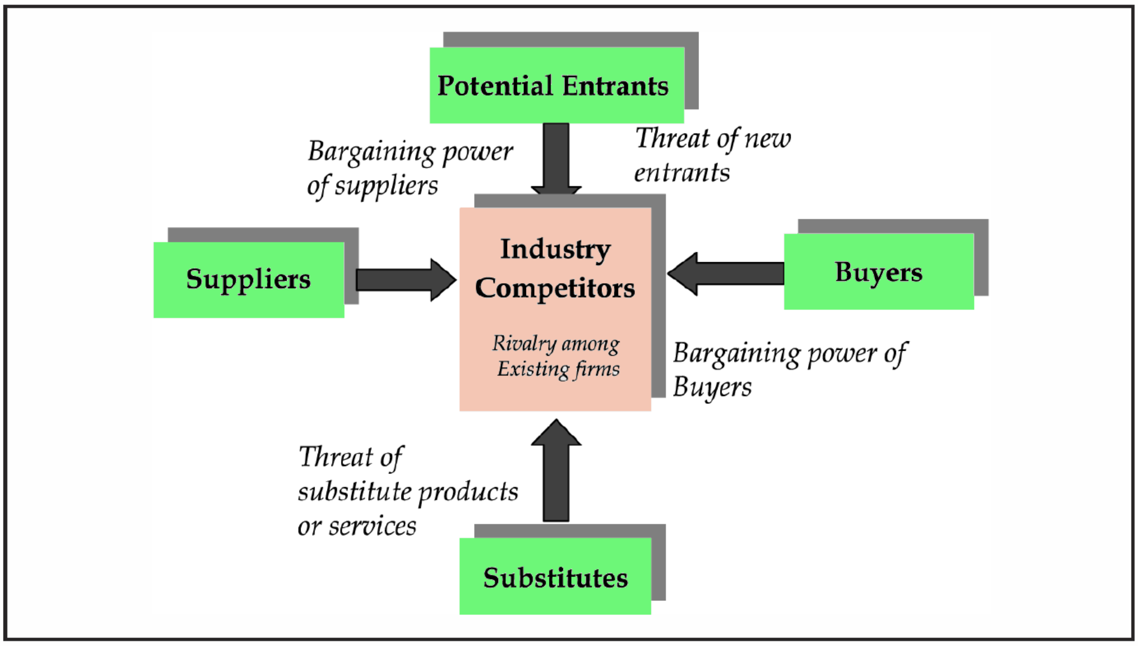


Figure 3: Porter's Five Forces Model. *Source: (Karagiannopoulos et al., 2005)*

Managing strategically from the I/O perspective, entails firms striving to compete in attractive industries, avoiding weak or faltering industries, and gaining a full understanding of key external factor relationships within that attractive industry. I/O research was mainly conducted from the 1960s to the 1980s and provided important contributions to the understanding of how to gain competitive advantage. I/O theorists contend that the industry in which a firm chooses to compete has a stronger influence on the firm's performance than do the internal functional decisions managers make in marketing, finance, and other areas of operations. (David, 2011b), considers rivalry among competing firms to be one of the most powerful of the five competitive forces. The strategies pursued by one firm can be successful only to the extent that they provide competitive advantage over the strategies pursued by rival firms. Strategic measures adopted by one firm, can, and usually are met with retaliatory countermoves, such as lowering prices, enhancing quality, adding features, providing services, extending warranties, and increasing advertising. The easy access to information that the Internet now provides is creating market pressures that have the effect of driving down prices and inflation worldwide. The Internet, coupled with the use of the common currency in Europe (but for how long?), now enables consumers to compare prices easily across different countries.

1.3. Barriers To Entry

Barriers to entry in the industrial-organisation literature go back to (Bain, 1993). He focused on the consequences of the barriers to entry, which relates to a higher price than the price hypothetically attributed to long-run equilibrium in pure competition. If the most efficient entrant of all potential entrants cannot enter the market then there is said to be a barrier to entry. The barriers are based on structural aspects of the market and behaviour of the incumbents to influence the conditions of entry. The structural conditions permit incumbents to raise the price above the minimum average cost of potential entrants. A slightly different perspective in the industrial-organisation literature is to look at the costs that must be incurred by an entrant to a market that need not be incurred by an organisation already operating in the market. This implies that the incumbents and entrants are not equally efficient after the costs of entering are taken into account. According to the traditional view in I/O, a level of profitability in excess of equilibrium induces entry into an industry. First, new entrants provide an equilibrating function in the market; the levels of profitability and prices are restored to their long-run competitive levels. Second, entrants are viewed as agents of change (Audretsch, 2001). The threat of entry, forces existing companies to introduce new products and processes. In this perspective, small firms are not created in order to be smaller versions of big firms but they serve as agents of change through innovative activities. As a result, entrants are important because of their destabilising influence (Audretsch and Mata, 1995). In this way, they play an important role in the dynamics of markets and competition. Given both arguments, entry is viewed as important for the dynamics of an industry.

If barriers to entry exist, this is detrimental for industry dynamics and economic welfare. Therefore, lowering barriers to entry or preventing the creation of these barriers is an important issue with regard to competition policy. A reduction in barriers to entry is currently perceived as one of the main objectives of competition policy (Burke and To, 2001), and the intensity of rivalry among competing firms tends to increase as the number of competitors increases, as competitors become more equal in size and capability, as demand for the industry’s products declines, and as price cutting becomes common. The Internet coupled with the use of BI is now having a profound effect on the nature of opportunities and threats by altering the life cycles of products, increasing the speed of distribution, creating new products and services, erasing limitations of traditional geographic markets, and changing the historical trade-off between production standardisation and flexibility. This is due to the fact that the technology allows for the altering of economies of scale by changing entry barriers, and redefining the relationship between industries and suppliers. To reflect this change in the use of Internet technology, organisations are establishing two new positions in their firms, that of the Chief Information Officer (CIO), and Chief Technology Officer (CTO). These two positions have very different roles. The CIO is more of a general manager, managing the overall external-audit process, whereas the CTO is more of a technician, focusing on technical issues such as data acquisition, data processing, decision-support systems, and software and hardware acquisition. No organisation or industry today is insulated against emerging technological developments. In high-tech industries, the identification and evaluation of key technological opportunities and threats forms a key aspect of strategic management.

There are however, some researchers who, in terms of strategic management, place more emphasis on the internal capabilities of an organisation. (Grant, 2002) states that; *"In a world where customer preferences are volatile, the identity of customers is changing, and the technologies for serving customer requirements are continually evolving, an externally focused orientation does not provide a secure foundation for formulating long-term strategy. When the external environment is in a state of flux, the firm's own resources and capabilities may be a much more stable basis on which to define its identity. Hence, a definition of a business in terms of what it is capable of doing may offer a more durable basis for strategy than a definition based upon the needs which the business seeks to satisfy."* In order for organisations to gain a better understanding of their internal capabilities, Porter proposes the use of the value-chain model, illustrated in Figure 4, which highlights specific operational areas within the business where competitive strategies can be best applied (Porter, 1998). The value-chain model highlights specific activities in the business where competitive strategies can best be applied and where IS are most likely to have a strategic impact.

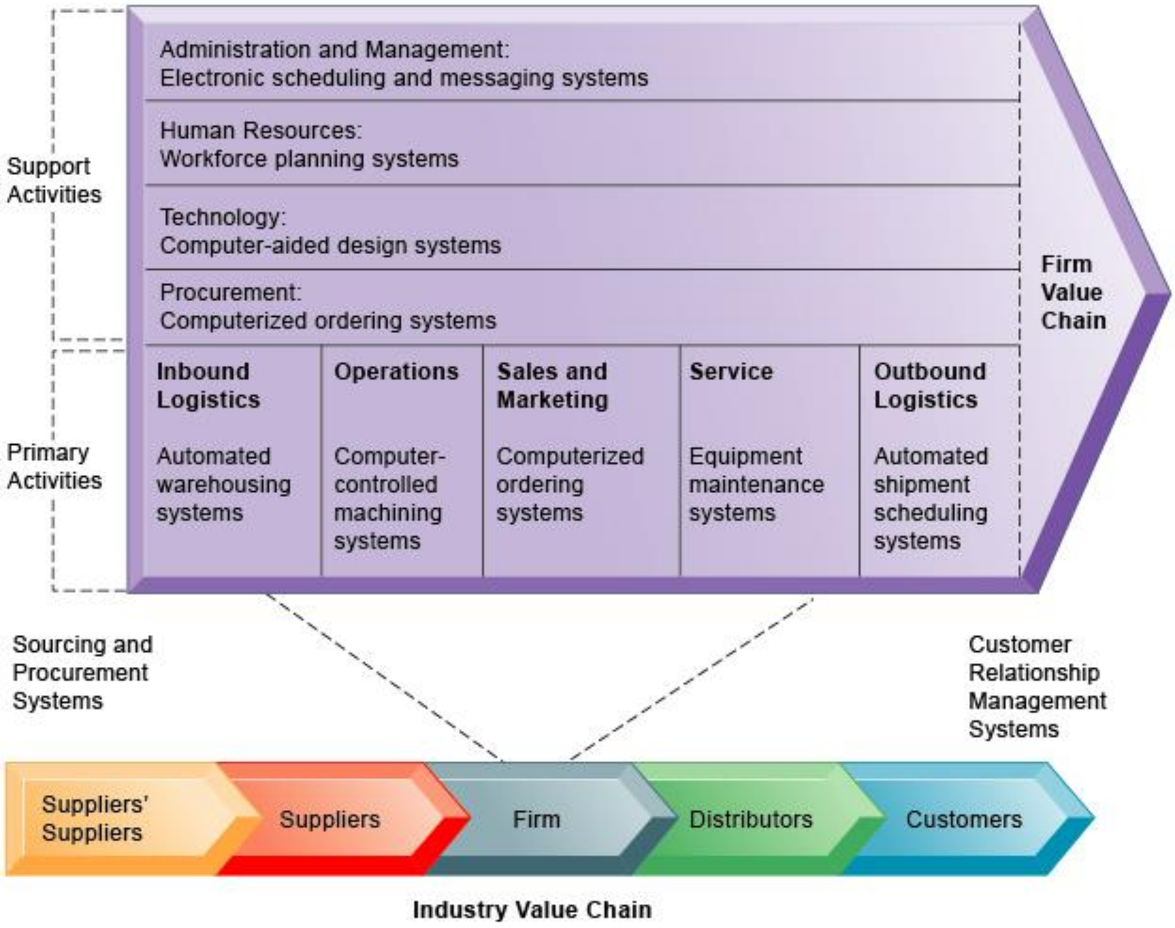


Figure 4: Value chain Primary and Support Activities. *Source: (Laudon et al., 2011)*

The value-chain model views the firm as a series or chain of basic activities that add a margin of value to a firm's products or services. These activities can be categorised as either primary activities or support activities. Primary activities are most directly related to the production and distribution of the firm's products and services, which create value for the customer. Primary activities include inbound logistics, operations, outbound logistics, sales and marketing, and service. Support activities make the delivery of the primary activities possible and consist of organisation infrastructure (administration and management), human resources (employee recruiting, hiring, and training), technology (improving products and the production process), and procurement (purchasing input) (Laudon *et al*., 2011). Within the value-chain, a framework that has emerged within "*strategic-thinking"* is an approach that attempts to explain, how an organisations resources drive its performance in a dynamic competitive environment. This approach has become known as the Resource Based View of an organisation (RBV), which is illustrated in Figure 5. The RBV combines the internal analysis of processes within companies with the external analysis of the industry and the competitive environment.

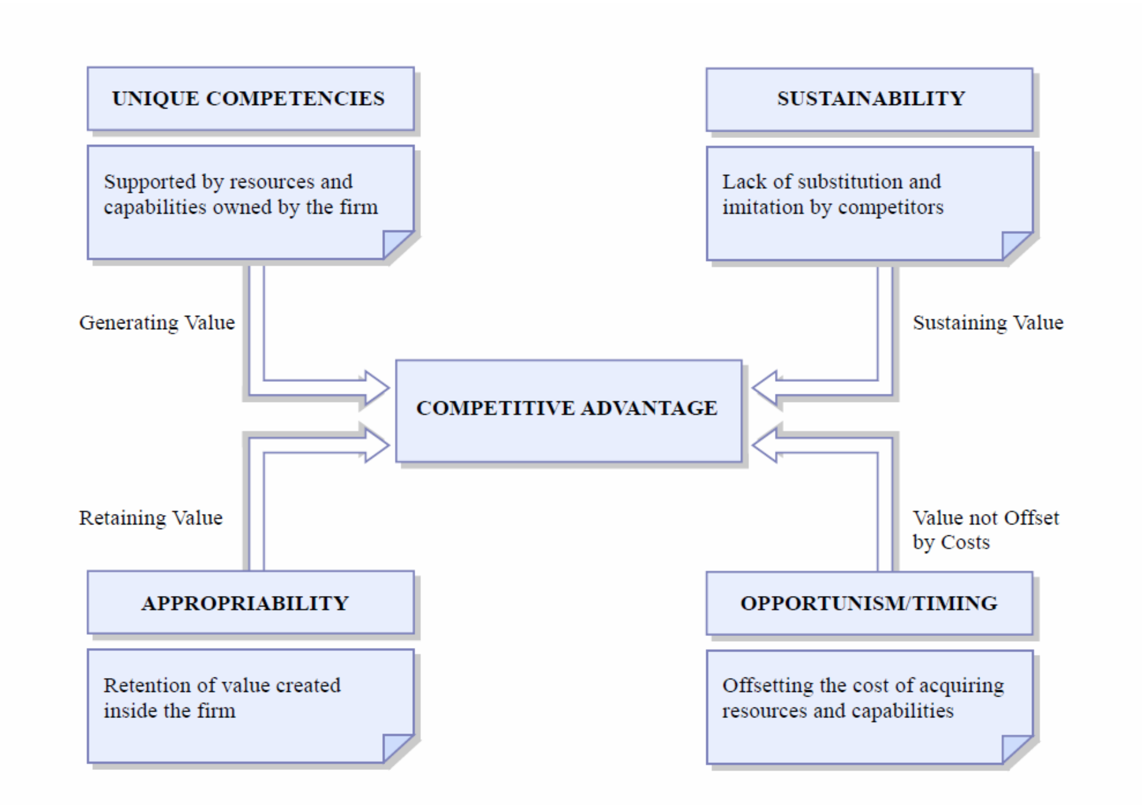


Figure 5: The resource based view elements of competitive advantage. *Source: (Hax and Wilde, 2002)*

The main strength of this model comes from its ability to explain in clear managerial terms why some competitors are more profitable than others, how to put the idea of core competence into practice, and how to develop diversification strategies that make sense. The RBV views organisations as very different collections of physical and intangible assets and capabilities. No two companies are alike, because no two companies have had the same set of experiences, acquired the same assets and skills, or built the same organisational cultures, which also applies to many diversely located operations within the same organisation. These assets and capabilities determine how efficiently and effectively a company performs its functional activities. Following this logic, a company will be positioned to succeed if it has the best and most appropriate set of resources for its business and strategy (Collis and Montgomery, 1995). The RBV emphasises the internal capabilities of the organisation in formulating strategy to achieve a sustainable competitive advantage in its markets and industries. If the organisation can be viewed as a set of resources and capabilities which can be configured to provide it with competitive advantage, then its perspective changes from an external to an internal one, therefore, its internal capabilities determine the strategic choices it makes in competing in its external environment. In some cases an organisation's capabilities may actually allow it to create new markets and add value for the consumer, such as Apple's iPod and Toyota's hybrid cars. Clearly, where an organisation's capabilities are seen to be paramount in the creation of competitive advantage it will pay attention to the configuration of its value chain activities. This is because it will need to identify the capabilities within its value chain activities which provide it with competitive advantage (Henry, 2008).

1.4. Strategic Management

The strategic-management process can be described as an objective, logical, systematic approach for making major decisions in an organisation (Brews and Purohit, 2007). The formulation and the conceptualisation of strategies is essentially the same process across a broad range of organisations, irrespective of their size, or whether they operate in the private or public sector. There is however, an on-going debate among academics and practitioners of strategic management as to the extent to which the process should be more objectively based, as opposed to a subjective assessment. Mintzberg coined the term *"crafting strategies"* to refer to the more subjective approach (Mintzberg, 1987). However, this approach, has not found favour among the broad academic community, with many preferring to utilise a more objective approach. There is, no doubt, a case for using intuition, judgment, feelings, and past experiences when making strategic decisions, but the analysis of the underlying key internal and external information should form the basis of the strategic management process. Mintzberg's idea of *"crafting"* strategies encompasses an element of the artistic model, which suggests that strategic decision making should be based primarily on holistic thinking, intuition, creativity, and imagination (Seo and Barrett, 2007). Mintzberg and his proponents reject strategies that result from objective analysis, preferring instead subjective imagination. However, there are those who reject the idea of basing strategy on ideas that emerge from emotion, hunch, creativity, and politics. Proponents of the artistic view often consider strategic planning exercises and development matrices to be time poorly spent. Mintzberg encourages managers to benefit from their experiences and the experiences of others through forums of discussion and debate, what he explains as, learning from the real life situations they have met in their working lives. He thinks that experience is a better teacher than any textbook. His philosophy embraces the idea of Managers being encouraged to meet up locally in their own time to discuss their work and the demands it places on them. Mintzberg purports that there are 6 different types of organisational framework whereby coordination can be achieved:

- Mutual adjustment; coordination is cooperatively achieved through informal communication (as between two operating employees).
- Direct supervision; one person issues orders to several other people.
- Standardisation of work processes; people fulfil one part of the work process which interrelates with the work of others.
- Standardisation of outputs; work targets are issued or products are standardised.
- Standardisation of skills; people have subject specialisms (such as doctors) and they coordinate with other specialists.
- Standardisation of norms; work of a whole organisation is governed by standardised norms and these control the work.

The Mintzberg philosophy places a greater emphasis on informality as opposed to formality. Certainly the two approaches are not mutually exclusive, but Mintzberg refers to strategic planning as an *"emergent"* process whereas more objective proponents use the term *"deliberate"* process (Mintzberg and Waters, 1985). The idea of *"doing"* is very much at the heart of Mintzberg's thinking. He cites the example of two managers who had just started up a furniture distribution company. One day they were struggling, in an attempt to put a table into the back of a car. One of them suggested that it would be a great help, if it was possible to collapse the legs of the table, and in that instant, the idea of the flat-pack, the corner stone of the IKEA strategy was born. Another story he tells, is that of a manager from a Mexican company, who attended his lectures in Massachusetts. Upon returning to his company after the lectures, the very first thing the manager did was have a large round table positioned on the factory floor, where he could discuss production issues with his employees on a daily basis. This had a significant effect of raising both morale, and productivity within the plant.

The deliberate process contends that it is unwise for strategists to rely too heavily on gut feeling and opinion in the absence of research data, competitive intelligence, and analysis in formulating strategies (David and David, 2009). Competition is at the core of the success or failure of any organisation. Competitive strategy, on the other hand, is the search for a favourable competitive position in an industry and is aimed at establishing a profitable and sustainable position against the forces that determine industry competition (Porter, 1998).

Strategic management is a methodology that is employed extensively by many organisations to withstand intense market competition. Strategy has been defined as; *"the match an organisation makes between its internal resources and skills, and the opportunities and risks created by its external environment"* (Buzzell and Gale, 1987). The case for making the resources and capabilities of the firm the foundation for its long-term strategy rests upon two premises: first, internal resources and capabilities provide the basic direction for a firm's strategy, second, resources and capabilities are the primary source of profit for the firm (Grant, 2002). Successful strategies are based on an understanding of the macro environment, the industry and the organisation's internal environment. Knowledge about the complexities of these environments enables the organisation to better choose how and where to compete most effectively, given its products, services, capabilities and limited organisational resources (Radder and Louw, 1998).

The strategic management process consists of three stages: strategy formulation, strategy implementation, and strategy evaluation (David, 2011a). The analysis of external opportunities and threats as well as the internal strengths and weaknesses of the enterprise is important for strategy formulation and development. The purpose of the analysis of external opportunities and threats is to evaluate whether an enterprise can seize opportunities and avoid threats when facing an uncontrollable external environment, such as fluctuating prices, political destabilisation, and social transitions within society (Chang and Huang, 2006). Volatility which has arisen in the Eurozone within recent years has resulted in many organisations facing all of these challenges simultaneously, which presents a major challenge to the management teams within these organisations. Strategy formulation techniques can be used throughout the three stages of the *"The Strategy-Formulation Analytical Framework"* as illustrated in Figure 6. Within this Framework, stage two, the matching stage is the province where an organisation defines the match between its internal resources and skills, and the opportunities and risks created by its external factors. Within this stage a number of different techniques have been developed that can be applied within the framework, these are: the SWOT Matrix, the SPACE Matrix, the BCG Matrix, the IE Matrix, and the Grand Strategy Matrix. The matching of the internal and external Critical Success Factors (CSF's) is considered to be an essential key with regard to an organisations ability to generate feasible alternative strategies.

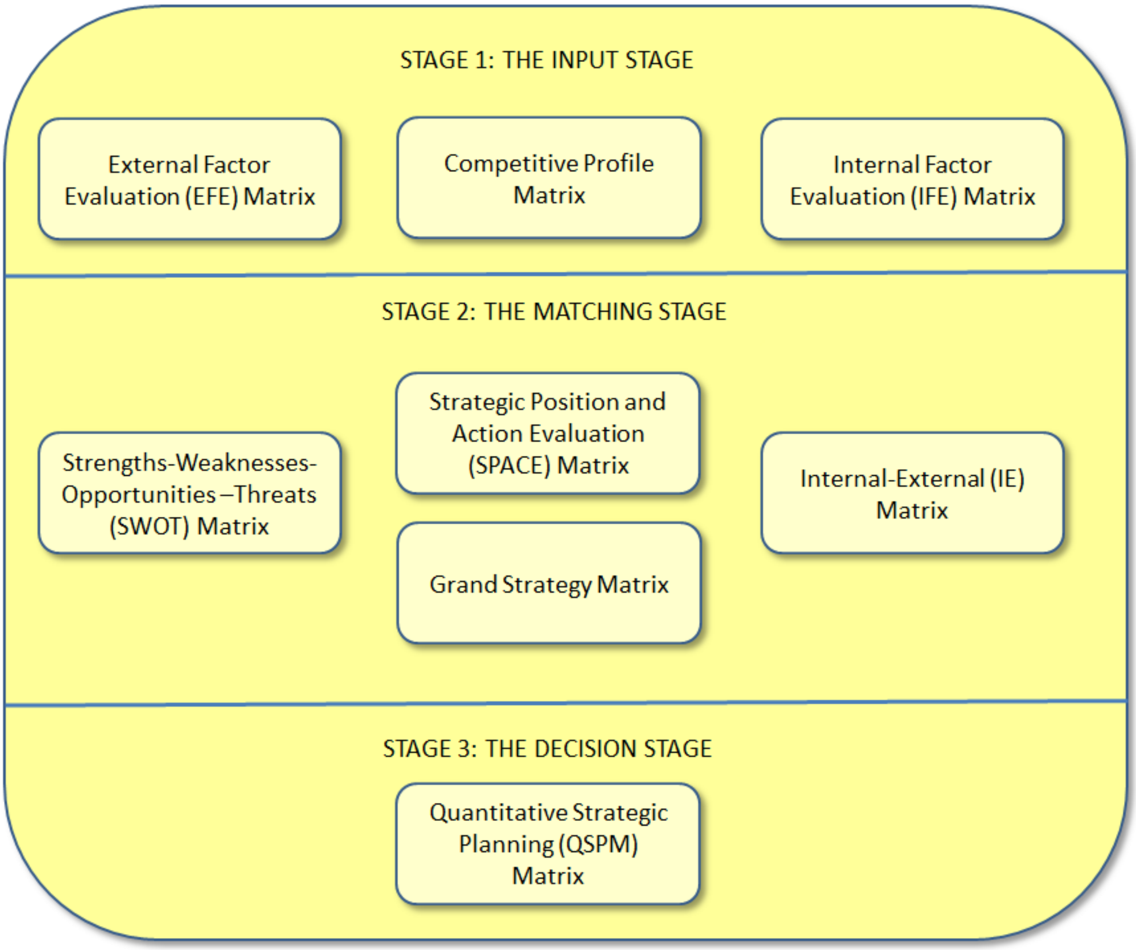


Figure 6: The Strategic-Formulation Analytical Framework. *Source: (David, 2011b)*

Although, each of these techniques offers a number of insights into the external environment, they also have a number of limitations. The Strategic Position and Action Evaluation (SPACE) Matrix illustrated in Figure 7, represents an alternate methodology, which if applied correctly, has the ability to overcome some of these limitations, In this model, the overall attractiveness of the industry in which the organisation operates is measured on one axis, while the other axis represents the organisation’s ability to compete within a given market. An additional strength of the SPACE Matrix methodology is that it adds two key dimensions to the matrix, i.e., the industry’s stability or turbulence, and the organisation’s financial strength. The strategic posture of an organisation as determined by utilising the SPACE matrix is based on two internal dimensions and two external dimensions. The internal dimensions; Financial Position (FP), and Competitive Position (CP), are the major determinants of the organisation's strategic position, whereas the external dimensions of; Stability Position (SP), and Industry Position (IP), characterise the strategic position of the entire industry. The different dimensions result in an aggressive, competitive, conservative or defensive strategic posture for the organisation. These postures, in turn, can be translated into generic competitive strategies, thus assisting management in defining the appropriate strategic thrust for the business, i.e., overall cost leadership, differentiation, focus or defensiveness.

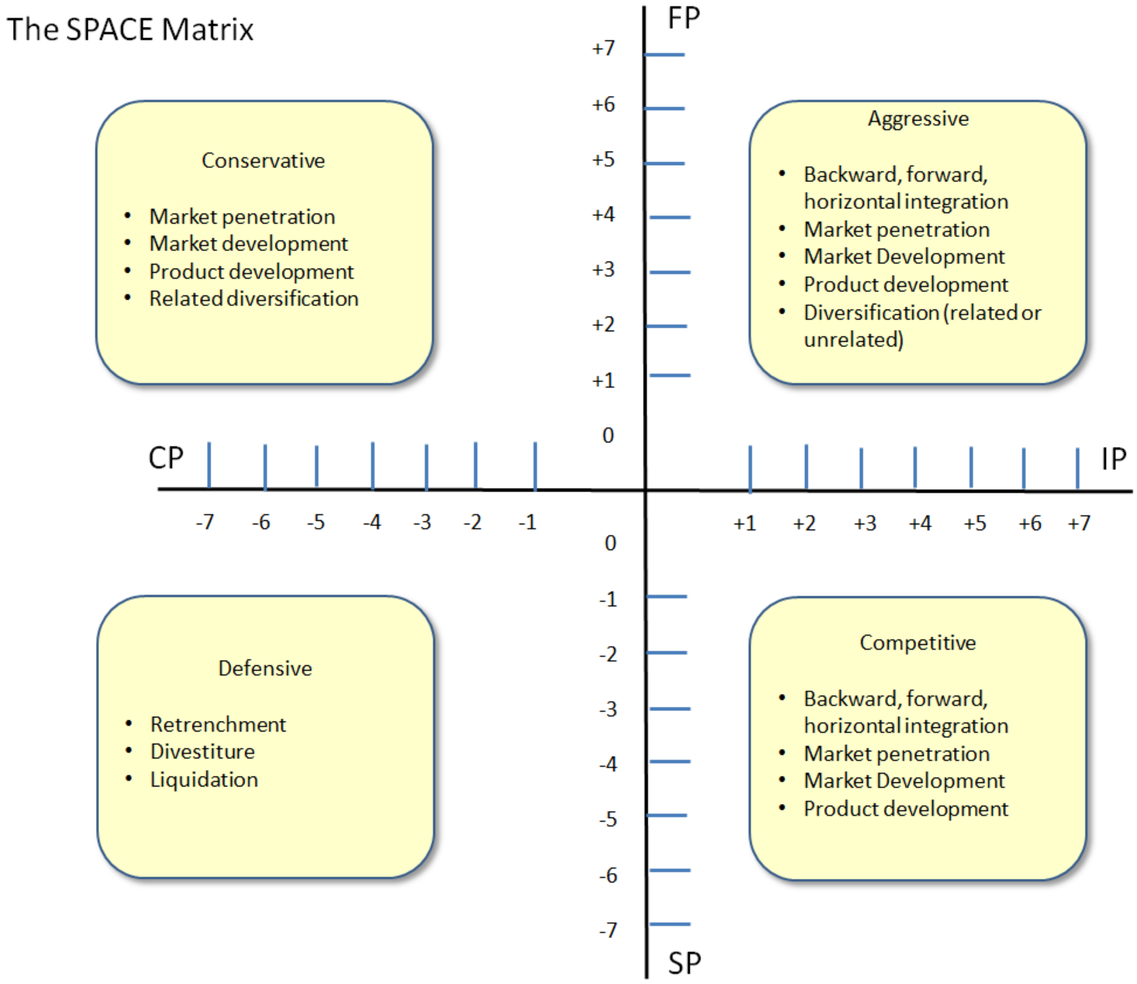


Figure 7: The SPACE Matrix. *Source: (Rowe et al., 1985)*

Each of the four dimensions comprises several key factors which are studied individually. The key factors which determine SP include: technological change; rate of inflation; demand variability; price range of competing products; barriers to entry into the market; competitive pressure and price elasticity of demand. Factors determining IP include: growth and profit potential; financial stability; technological know-how; resource utilisation; capital intensity; ease of entry into the market and productivity or capacity utilisation. The CP is of specific importance to marketers. Critical factors in this dimension are: market share, product quality; product life cycles and product replacement cycles. Other variables include: customer loyalty; competition's capacity utilisation; technological know-how and vertical integration. Factors influencing the fourth dimension FP, include: return on investment; leverage; liquidity; capital required/available; ease of exit from the market and the risk involved in the business (Rowe *et al*., 1985).

1.5. Significance of Research

A question that that has a high priority, in terms of strategic management within many an organisation is; how to develop information architecture and IT infrastructure that can support the goals of the organisation when business conditions and technologies are in a constant state of flux. Meeting the business and technology challenges of today's digital economy requires redesigning the organisation, and building new information architecture and IT infrastructure. Information architecture is the particular form that information technology takes in an organisation to achieve selected goals or functions. It is a design for the business application systems that serve each functional specialty and level of the organisation and the specific way that they are used by each organisation. As firms move toward digital firm organisations and technologies, information architectures are increasingly being designed around business processes and clusters of system applications spanning multiple functions and organisational levels (Kalakota and Robinson, 2001). Because managers and employees directly interact with these systems, it is critical for organisational success, that the information architecture meet business requirements now and in the future. Figure 8 illustrates the major elements of information architecture, which shows the firm's business application systems for each of the major functional areas of the organisation (Laudon *et al*., 2004). Many organisations in recent years have implemented ERP systems in an effort to coordinate activities, across different functional areas and also to increase the efficiency of their extended supply chains. Not all of these implementations have been successful, nor have they achieved in many cases, the type of results that were initially envisaged at the outset. The key benefits that managers seek to derive from the implementation of ERP systems are to: considerably reduce or totally eliminate the fragmentation of current systems, to allow a process of standardisation, to give more visibility on data across the entire corporation, and, in doing so, obtain competitive advantage (Sammon and Adam, 2004a). ERP projects, have therefore, been described by (Shakir, 2000) as strategic projects with success or failure that will greatly impact the organisation. It has been noted however, by a number of authors that failed implementations can be costly for the implementing organisation, and that few ERP implementations have been entirely successful. (Kalakota and Robinson, 2001).

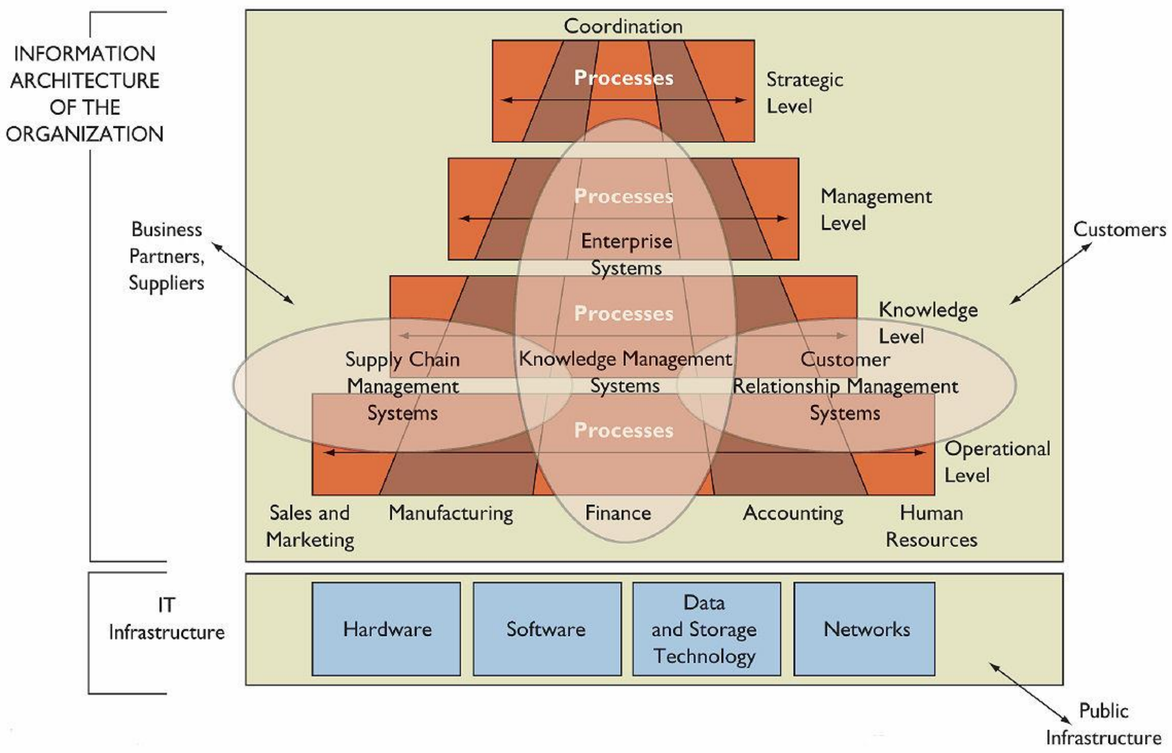


Figure 8: Information Architecture of the Organisation. *Source: (Laudon et al., 2004)*

One of the reasons that ERP projects fail to realise their potential, is that project teams can get immersed in the implementation of ERP while forgetting the reasons that lie behind the implementation from a strategic perspective, and they allow ERP to become a driver rather, than the enabler that it is intended to be. IT is purported to be both an *"enabler"* and *"driver"* of change (Azvine *et al.*, 2005), *"demanding the fashioning and incorporation of new roles, responsibilities, relationships, lines of authority, control mechanisms, work processes and work flows; in short, new organisational designs"* (Porter and Millar, 1985), *"enabling the rationalisation of work and the better functioning of teams and by the transformation of work practices"* (Heinemann and Rau, 2003), and *"increasing process efficiency, changing the locus of knowledge and power, forcing old organisational structures into new configurations"* (Kaplan and Haenlein, 2010). A number of limitations with regard to the capabilities and the usability of ERP systems in providing effective Supply Chain Management (SCM) support, have been identified by (Akkermans *et al.*, 2003), which are: their insufficient extended enterprise functionality in crossing organisational boundaries, their inflexibility to ever-changing supply chain needs, their lack of functionality beyond managing transactions, and their closed and non-modular system architecture. Along with these (Häkkinen and Hilmola, 2008), also identify, what they describe as key limitations of ERP systems in providing effective business support, such as; the inflexibility of current ERP systems to ever-changing business needs; and their lack of functionality beyond managing transactions.

1.6. Thesis Hypothesis

It is the purpose of this doctoral thesis to demonstrate that despite the concerns which have been outline above, that:

ERP and BI strategies, when correctly applied, and in combination with e-marketing and well thought out Website development, can produce a synergy greater than the effect of any individual component, which can greatly enhance the overall profitability of an organisation, in a way which has not been previously realised.

The primary research objectives that this thesis addresses are as follows:

- To evaluate how ERP can be employed to provide an internal competitive advantage and how BI can be best employed in order to leverage the benefits of existing ERP systems.
- To investigate the role of BI in facilitating organisations in their efforts to achieve external competitive advantage and the extent to which organisations are leveraging the synergy that BI Solutions can offer.
- To gain an understanding of the drivers and barriers for organisations who wish to employ BI technology.

This Doctoral Thesis is significant for the following reasons:

- It identifies a gap in the existing BI literature and presents a novel perspective in relation to the psychological aspects of ERP and BI adoption.
- This perspective provides the ability to gain a deeper understanding of why a large percentage of ERP and BI programmes, which, on the face of it, had all the positive indicators in terms of programme success, but in reality, did not achieve the outcomes that were desired of them.
- It provides the ability to inform the decision making process when organisation are considering implementing ERP and BI programmes.

- This perspective adds to the existing body of knowledge of BI and ERP implementation programmes.
- It provides an understanding of the technologies and methodologies that lie behind ERP and BI solutions.
- It demonstrates a practical application of these technologies within a modern business context.
- It illustrates how a number of important business management techniques can be successfully applied in an effort to resolve problems that arise in modern supply chain management.

The march of IT within the business environment is remorseless, and business managers find that they must contend with evolving technological issues, and ways of doing business as part of their daily lives. For those managers that fail to stay abreast of the technological curve, the impact can be serious. Many perfectly good managers, with an excellent work ethic and a strong sense of loyalty to their organisations, have unfortunately found themselves on the wrong end of the technology continuum as it applies to their working environment. An inability to be able to harness the benefits of using IT as part of the everyday working routine has unfortunately resulted in the careers of these otherwise fine individuals ending prematurely. This thesis, although primarily written to demonstrate how integral IT has become within the working environment and thus aimed at the IT practitioner, is also very much of interest to management who wish to be able to harness the power of IT to ensure that their efforts align with the overall strategic goals of the organisation, and will also be of interest to anyone who has an interest in promoting the Customer Relationship Model (CRM) through the use of Business Intelligence. Its purpose is to provide a greater understanding of how organisations can implement a combination of strategic management techniques from both an internal and external perspective in order to gain a sustained competitive advantage. The thesis should therefore, be of interest to the following groups of people:

- Students of Enterprise Resource Planning, Business Intelligence and, Customer Relationship Management, who wish to gain a fuller understanding of the academic writings, research and concepts which underline these important subject areas within Strategic and Operations Management.
- Executives, managers and supervisors who have an interest in the application of Information Technology systems and wish to gain a fuller understanding of

their application within a BI context, and also to observe a practical instance of the technology within the CRM framework.

- System administrators, who wish to gain a working knowledge of the tools and techniques which can be applied to align technology with the strategic vision of the organisation.
- Professionals who have an interest in the methods that can be applied to leverage, IT and IS systems in order to dramatically improve the Customer Relationship Model.

1.7. Structure of the Thesis

This thesis is structured as illustrated in Figure 9 below, which represents the roadmap to guide the reader through the different phases of the research approach taken. It consists of eight chapters and a set of five appendices. This chapter outlines the primary research questions addressed within the thesis, and also the purpose and significance of this research; it then describes the structure of the document to follow.

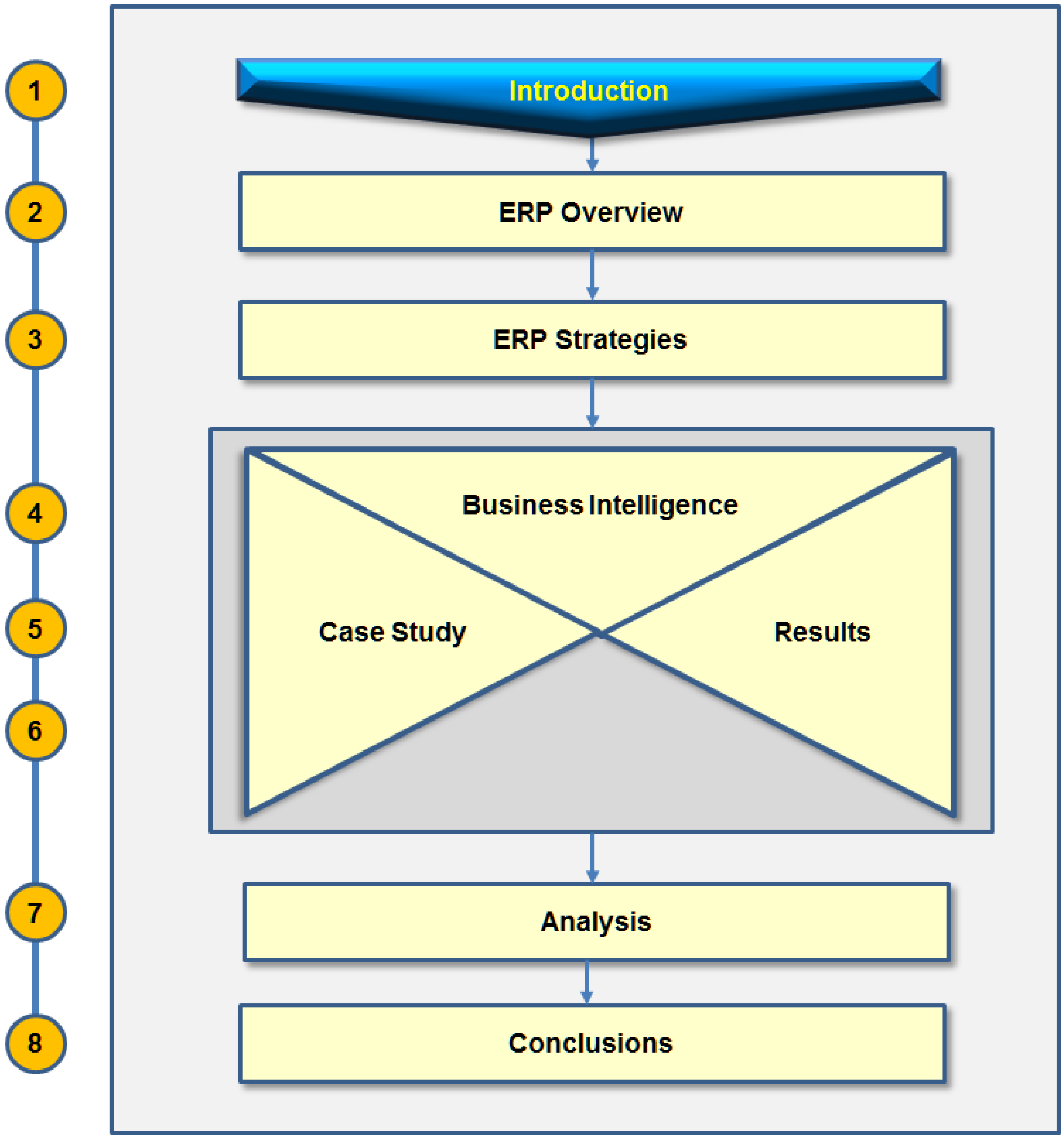


Figure 9: Thesis Structure and Roadmap

Chapter 2 ERP Overview; This starts by providing an overview of the evolution of ERP, which includes a brief history of the major vendors of ERP software. A number of definitions of what constitutes ERP is then provided, which come from both academic and professional sources. The author is of the opinion that the focus of these definitions is somewhat narrow and, a more holistic definition of ERP is proposed, built around the concepts of quality, and strategic vision. The concept of the ERP Life cycle is introduced, which encompasses all the issues around the Total Cost of Ownership. Factors relating to the deployment of ERP and how to evaluate the progress of the deployment effort are then discussed. This is then followed by a discussion on techniques that can be adapted in relation to the optimisation aspects of ERP. The issue of whether ERP offers, or does not offer a competitive advantage are analysed, and in particular the views put forward by Carr (Carr and Johansson, 1995, Carr, 2003, Carr, 2004), in relation to this particular topic. The chapter concludes by looking at what constitute the CSF's of an ERP implementation, which is a topic that has been much discussed within the literature.

Chapter 3 ERP Strategies; It is now well recognised that the strategic decisions which are made at the executive and senior management level within an organisation with regard to the implementation of ERP, will have a tremendous bearing on the outcome of the programme with respect to its success or failure. The strategic perspective incorporates the following elements; the strategy with regard to the adoption of ERP, and the extent and scope of the deployment within the organisation. To this end it is absolutely critical that the CEO and the executive level management within the organisation have a clear vision of how the ERP implementation fits in with the overall strategic alignment of the organisation. The putting in place of a strong project team to drive the ERP programme forms a core element of the strategy. Management must also recognise the impact that the ERP implementation will have upon the organisational structures within the organisation, and the steps which are required in order to smooth the transition. Training and education of all those impacted by the implementation forms a key element of the strategy, and the resources to facilitate this have to be taken into account as part of the strategy. How the organisation transitions from legacy systems is a key element of the transformation within the organisation. Finally the issues surrounding aspects of system testing and evaluation are discussed.

Chapter 4 Business Intelligence; This chapter introduces the components that are now considered to be the building blocks of the aspect of organisational operations that is now referred to as Business Intelligence. Many organisations now recognise that in order to take the business to the *"next level"* in terms of supply chain management and customer relationship management, it is essential to employ aspects of BI within their operations. Key elements of the BI structure include; the creation of a data warehouse, along with, data mining, which is a set of tools and techniques, which provide the ability to obtain *"actionable knowledge"* from within it. The data contained within a data warehouse will come from numerous sources, and it therefore, it will not all be of the same structure. In order to make all of the data usable, it is necessary to change, or transform it into a common structure. In order to do this a methodology referred to as Extract Transform and Load (ETL) is employed. The tools and methodologies used to accomplish this are discussed. The ability to be able to query and analysis the data base from a number of different perspectives is a key managerial requirement. A set of protocols referred to as, On Line Analytical Processing (OLAP) facilitates in fulfilling this requirement, and in particular how data is queried using the *"OLAP Data Cube"* is discussed. There is now a growing realisation that CRM leads to higher customer profitability. The techniques that are employed to achieve this are reviewed, along with the supporting capabilities of Geographic Systems and Dashboard Reporting.

Chapter 5 The Case Study; provides a brief description of the organisation, that the case study is based upon, which was founded in Belgium in the early 1900s and has approximately 3,000 stores worldwide employing nearly 150,000 people. Store formats are primarily general outlets, which represent about 90% sales network. Sales amount to €20 billion per year with a net income approaching €360 million. The Case Study provides a description of the environment in which the organisation operates, and the challenges that it faced, from both an internal and external perspective. It then discusses the particular implementation methodology that PDV embarked upon, which includes the vendor evaluation process, and it also discusses the importance of the benchmarking process, and its particular relevance within the case study. Much has been written on the subject of Total Quality Management (TQM), and the role of incremental improvement within it. However, there are times when a gap develops within an organisations competitive position that incremental improvement alone can't close in a timely manner. When this type of challenge arises within the organisation, then other alternatives must be sought out in order to restore competitive advantage. It is in this type of situation that Reengineering can be applied to great effect. However, Reengineering is not a task that should be approached without full consideration of all the variables involved. It will be demonstrated how PDV approached this particular challenge, and was able to implement a Reengineering strategy to great effect. Issues to do with change management legacy systems and going-live are also discussed within this chapter, and it then illustrates the particular BI solution adopted by PDV, and also how different strategies were brought to bear, which ranged from using such tools as the SPACE Matrix to other methodologies which included Neuromarketing techniques. It then demonstrates how through the use a number of business tools and strategies, the organisation was able to realise a significant strategic advantage in relation to its previous position within the sector, and also in relation to its position versus its competitors. The chapter concludes with specific techniques that were utilised within the development of the PDV Website.

Chapter 6 Results; discusses the results of the BI solution adopted by PDV. It, first discusses the reasons that PDV decided to implement this particular solution with regard to the challenges that were facing it at that time. It then discusses the strategic tools that were available to it, in terms of the task required, and the particular ones that it chose to use, based on a real time analysis of its operating position. The SPACE Matrix was chosen as a particularly relevant tool in this regard, the organisation having looked at other strategic tools, such as SWOT and BCG analysis, which PDV considered inadequate in relation to their particular requirements. The SPACE Matrix was not used in isolation, as PDV considered it to be prudent to utilise a number of other strategic tools as well. This included the use of financial analysis to assess the financial strength of the organisation, and also to inform management about the extent of the resources that it would be able to make available during the course of the Business Solution implementation and deployment. It is also demonstrated how inputs from the *"Gartner Hype Cycle"* influenced the thinking of senior management within PDV during that time. The effectiveness of Supply Chain Management within their organisations is a topic that is of great interest to many managers, this was no less so, in the case of PDV and it was very important, that the Business Solution that PDV implemented was able to influence this aspect of operations in a positive way. How this was achieved and the results emanating from it are discussed. Particular attention is paid to the role of forecasting within Supply Chain Management, and how this was also influenced in a very positive way by the BI programme. The role that inventory control plays within supply chains is critically important, and it plays a vital part in determining the overall profitability of the supply chain. Organisations like Dell have been able to demonstrate with great effect, how inventory can be practically eliminated from the supply chain, resulting in much leaner and profitable supply chains. The results obtained within PDV through the use of the BI solution were also quite impressive. The chapter concludes with a discussion of how to produce real-time reports to management, which are a key strategic tool in keeping management abreast of pertinent activity and events within the organisation.

Chapter 7 Analysis; is where the analysis of the thesis and he case study are both discussed. It starts by looking at the benefits that can be derived from ERP and BI systems, and then contrasts that with the costs involved. The benefits can be somewhat intangible, and therefore difficult to measure in a strictly monetary sense, and they include such items as; the agility, and the responsiveness of the organisation, coupled with other factors, such as, customer intimacy, information sharing, flexibility, and collaboration. This leads on to a discussion of the four dimensions of BI benefits, which are; Revenue Enhancements, Cost Savings, Management Process Improvement, and Operating Process Improvement. The primary research questions within the thesis are then addressed.

Objective One; discusses how BI can be used to achieve an internal competitive advantage, and how this was achieved within PDV. Within this part of the analysis, the subject of *"positioning and leveraging the technology"* within the organisation is discussed in some detail. Objective two addresses the topic of achieving external competitive advantage. The strategic framework, which was used as the basis of the analysis, is then discussed.

Objective Two; looks at the organisation from the external perspective, and the forces within the external environment which impact upon the organisation paying particular regard to the impact of ERP and BI solutions. In particular the effect of integrating a range of in store technologies is then discussed.

Objective Three; concentrates on the area of drivers and barriers in the context of BI solutions, and a comprehensive listing of both the drivers and barriers is provided. The author then goes on to address the subject of *"The Psychology of BI Integration"* which in the authors' opinion is a subject area that has not received sufficient attention within the literature. The author proposes the use of the *"BI Psychology Adoption Model"* which provides new thinking as to how employees react, when confronted with new technology within the workplace. The correct application of the model should assist in the task of informing management of the extent and scope of emotive reactions to the introduction of technology within the workplace. The author presents this model in Figure 10.

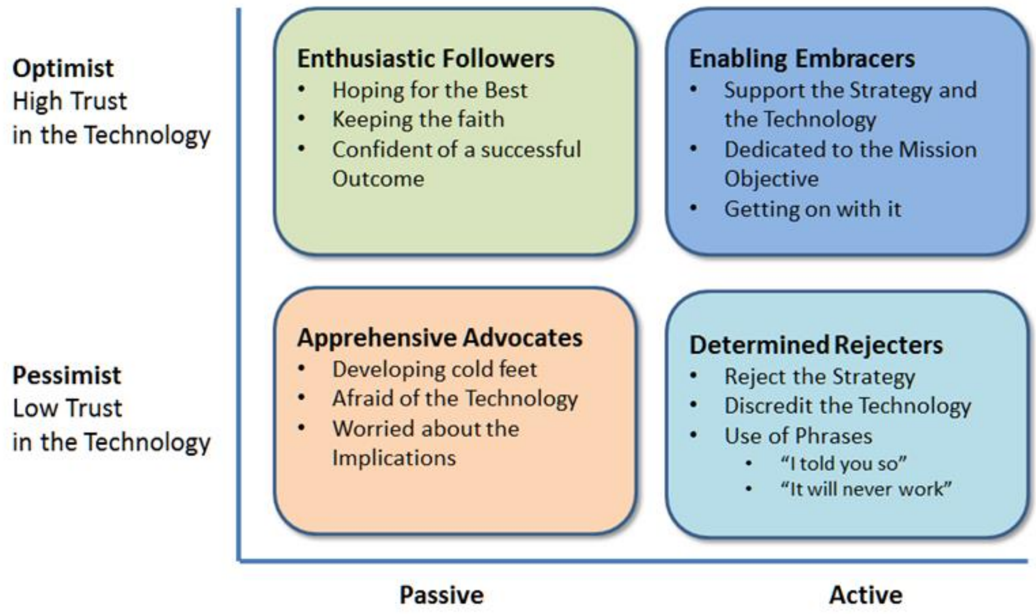


Figure 10: BI Psychology Adoption Model

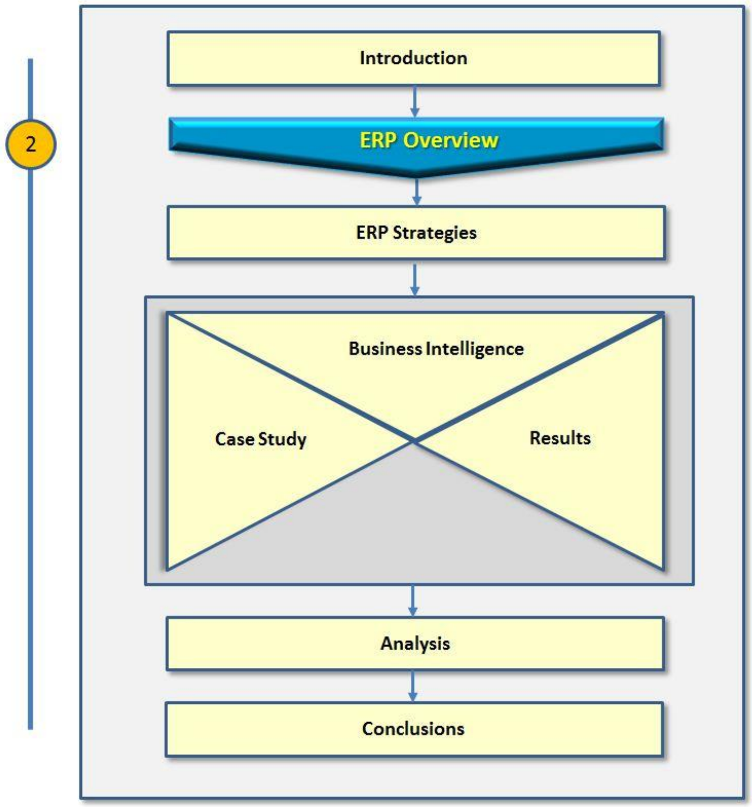
The author provides practical guidance as to how the model can be best applied across a range of circumstances which reflect employee's attitudes towards the introduction of new technologies, within the workplace.

Chapter 8 Conclusions; is the concluding chapter, which reflects on the methodologies which were employed in validating the thesis. One of the main themes within the thesis relates to the attaining and maintaining of a sustained competitive advantage through the use of modern computing and Internet technologies. The overall framework in which this was achieved is discussed at the commencement of this chapter. These same technologies also have a considerable impact on the supply chain within the organisation, and the effects brought about with regard to SCM are also discussed. Another major theme within the thesis is that of CRM and the implications of implementing a number of different technologies in order to achieve this are also reviewed. Of course, no technology can supply all of the solutions, to organisational requirements, and therefore, the limitations of the various technologies, with respect to the organisational requirements are also discussed. The author concludes by offering some future directions that the technologies may evolve into, along with some future directions for additional research.

Chapter Two

ERP Overview

"Enterprise resource planning software, or ERP, doesn't live up to its acronym. Forget about planning - it doesn't do that - and forget about resource, a throwaway term. But remember the enterprise part. This is ERP's true ambition. It attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs." - (Balsmeier and Nagar, 2002).



This chapter presents a literature review on the subject of ERP research, which includes a brief history of the major vendors of ERP software. A number of definitions of what constitutes ERP is then provided, which come from a range of academic, and professional sources. The concept of the ERP Life cycle is introduced, which encompasses many of the issues surrounding the Total Cost of Ownership and other factors relating to the deployment of ERP. Methodologies used to evaluate the progress of the deployment effort are then discussed. This is then followed by a discussion with regard to techniques that can be applied in relation to the optimisation of ERP. Enterprise Resource Planning is an industry term for integrated, multi-module application software packages that are designed to serve and support multiple business functions. Other terms used are: Enterprise ISs (EIS), Enterprise Wide Systems (EWS), or Enterprise Systems (ES). Enterprise systems are *"commercial software packages that enable the integration of transaction oriented data and business process throughout an organisation"* (Markus and Tanis, 2000). From the perspective of the firm, ERP systems are usually the largest and most demanding information systems implemented. Typically, an ERP system implementation is the largest single IT investment, impacts the greatest number of individuals, and is the broadest in scope and complexity (Chang et al., 2008). From the perspective of the individual user of an ERP system, ERP demands a broader set of information systems IS and business knowledge (Sein et al., 2001), changes job role definitions, increases task interdependencies (Kang and Santhanam, 2003), restricts flexibility in job tasks (Park and Kusiak*, 2005), and has been shown to lower job satisfaction (Butler and Gray, 2006).

ERP systems software packages are normally composed of several modules, such as; human resources, sales, finance and production, which provide, cross-organisational integration of transaction based data throughout a range of business processes. These software packages can be customised to the specific needs of each organisation up to certain limits (Esteves and Pastor, 1999). ERP software packages and solutions represent a multi-billion dollar industry that includes the world's fourth largest software vendor, several of the largest software firms and the world's largest management consulting organisations. These comprehensive, packaged software solutions seek to integrate the complete range of a business's processes and functions in order to present a holistic view of the business from a single information and IT architecture (Gable *et al*., 1997). At the heart of an enterprise system is a central database that draws data from, and feeds data into a series of applications supporting diverse company functions. Using a single database, dramatically streamlines the flow of information throughout a business (Davenport, 1998c). This is illustrated in Figure 11.

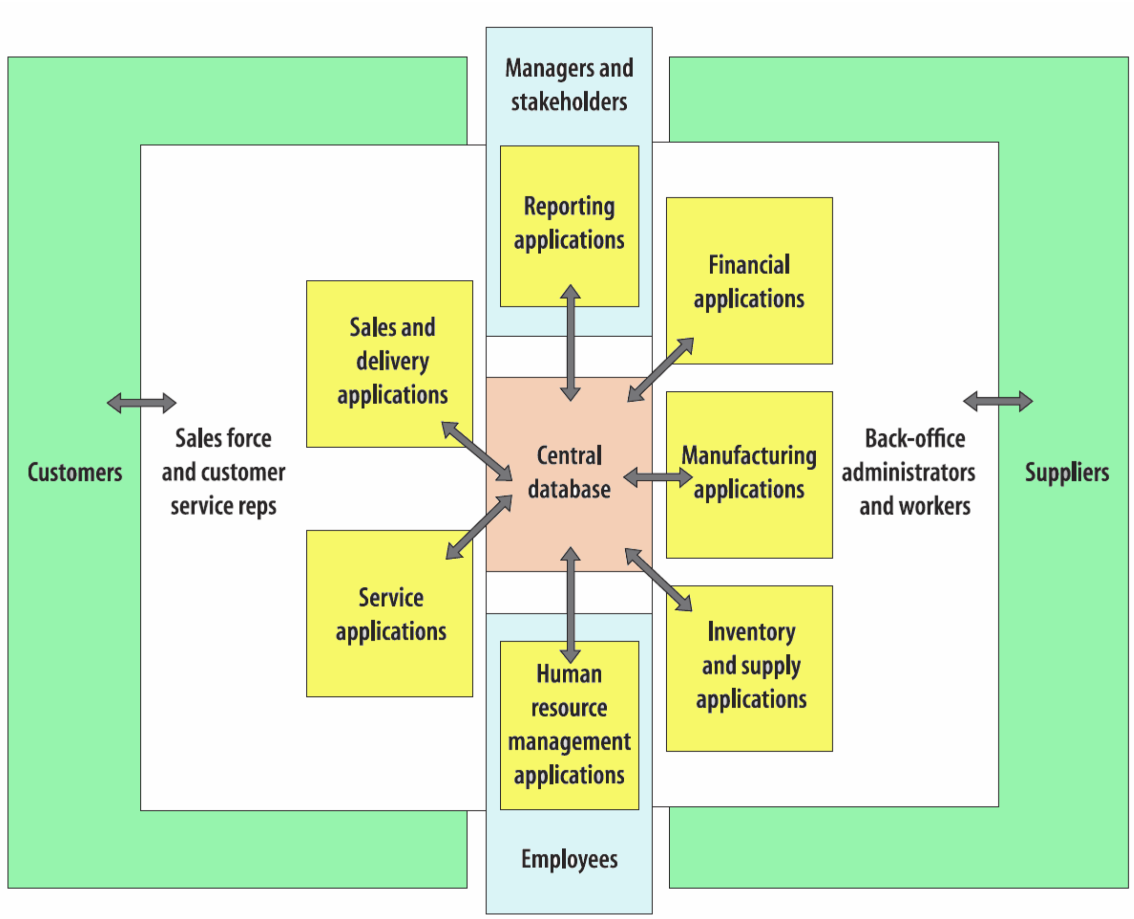


Figure 11: Anatomy of an Enterprise System. *Source:(Davenport, 1998c)*

2.1. Evolution

The origins of ERP can be traced back to the Industrial Revolution and the initial attempts at optimising industrial activities around functions such as, the purchasing of raw materials and the sale of finished goods. According to (Gilbert and Schonberger, 1983), the history of inventory-based production control systems, leading to the development of Material Requirements Planning (MRP), dates back to at least 1744, when an advertisement for a Franklin Stove consisted of an illustrated Bill of Materials illustrating the quantity of each component in the product and its assembly location. However, it was not until the early 20th century, when the car industry in America in the 1910s and 1920s, became more competitive, and the impact of material flow and availability of the manufacturing process, became a subject of managerial interest. It was this recognition, of the need for more flexible control techniques, as well as an understanding of the importance of forecasting in relation to manufacturing and, the provision of finished product, that was the catalyst for what we accept today as the development of inventory management and control techniques. These techniques are at the core of all ERP and Supply Chain Management (SCM) systems (O'Gorman, 2004).

ERP is the manifestation of a long line of approaches that have been brought to bear throughout the history of enterprise-level performances. Table 2 provides a list of the more significant enterprise performance-improvement movements during the last century.

Year	Performance Improvement Movement	Founder(s)
1690	Division of Labour	Adam Smith
1890	Scientific Management	Frederick Taylor
1900	Mass Production	Henry Ford
1920	Industrial Engineering	F. Gilbreth and Frederick Taylor
1930	Human Relations Movement	Elton Mayo
1950	Japanese Quality Revolution	J. M. Juran and W. E. Deming
1960	Materials Requirement Planning	William Orlicky
1970	Manufacturing Resources Planning	Oliver Wright
1970	Focused Factory	Wickham Skinner
1980	Total Quality Management	Philip Crosby
1980	Just In Time	Taiichi Ohno
1980	Computer Integrated Manufacturing	
1980	Optimised Production Technology	Eliyahu Goldratt
1980	ISO 9000	NASI
1980	World Class Manufacturing	Richard Schonberger
1990	Mass Customisation	Stan Davis and B. Joseph Pine
1990	Lean Manufacturing	Jones and Roos
1990	Business Process Reengineering	Michael Hammer
1990	Supply Chain Management	

Table 2: Timeline of Performance Improvement Movements. *Source: (Kale, 2000)*

Within the modern era, the focus of manufacturing systems in the 1960s was on Inventory Control. Most of the software packages at that time were designed to handle inventory, which was based on traditional inventory concepts. In the late 1970s and well into the 80s most companies who had an automated computerised system, used to write their own software for it, to control their business processes. This can be an expensive approach, since many of these processes occur across various types of businesses (Chang *et al*., 2000). At this time, the focus shifted to MRP systems that translated the Master Schedule (MS) built for the end items into *"time-phased"* net requirements for the sub-assemblies, components and raw materials planning and procurement. If common reusable software such as an ERP system is used, this provides for the possibility of a cost effective alternative to customised software. ERP software can cater to a wide range of industries, from service sectors like software vendors and hospitals, to manufacturing industries and even, to government departments

(Chang *et al*., 2000). In the early 1990s, MRP-II was further extended to cover areas like; engineering, finance, human resources and project management. At the beginning of this decade, IT commentators had suggested that, ERP systems were not enabling businesses to become more profitable, but were in fact slowly strangling them, because the main idea behind ERP itself i.e. the tight integration of business processes was not giving businesses the synergy that was expected. Also, the high cost of ERP implementation and initial low return on investment was one of the main factors taken into consideration when IT specialists talked about writing off ERP as a fad. However, market conditions continue to change, and the trend is for more organisations to become more globalised (Fallon, 2005). Within this context, the need for effective software solutions within a business context is more pressing than ever.

2.1.1 MRP to ERP

MRP, the predecessor of MRP II and ERP, was initially created in the late 1960s through a joint effort between J.I. Case, a manufacturer of tractors and other construction machinery, in partnership with IBM. At the time, this early MRP application software was the state-of-the-art method for planning and scheduling materials for complex manufactured products (Jacobs and Weston, 2007). MRP developed from the requirement to have some method whereby, a system schedules, and then releases time phased orders in such a way that, components and sub-assemblies arrive at a work station just at the moment that they are required. The benefits to be derived from such a system are: reduction in inventories, enhanced efficiency and effectiveness, resulting in improved customer satisfaction (Siriginidi, 2000), and as soon as organisations began to realise the benefits that could be derived from such systems, the imperative of competitive pressures led to the requirement for additional business functions to be included within the MRP functionality. These included, rough cut capacity planning, and capacity requirements planning for production scheduling which, then expanded into a company-wide system encompassing all of the organisations resources. In the late 1970s the primary competitive thrust was shifting towards marketing, which resulted in the adoption of target-market strategies with an emphasis on greater production integration and planning. MRP systems are able to provide this functionality, because of the integration between forecasting, master scheduling, procurement, plus shop floor control. MRP fairly quickly became established as the fundamental parts and materials planning concept used in production management and control. In 1975, IBM introduced its Manufacturing Management and Account System (MMAS) which, is considered to be the true precursor to

ERP. It created general ledger postings and job costing plus forecasting updates emanating from both inventory and production transactions, and could generate manufacturing orders from customer orders. J.D. Edwards began to focus on writing software for the IBM System/38 in the early 1980s. This system was a much lower cost alternative to the then mainframe alternative. It offered flexible disk drives with capacities useful for small and medium size businesses. The term MRP began to be applied to the increasingly encompassing functions, leading to the use of the phrase "Manufacturing *Resource* Planning" rather than "Material *Requirements* Planning". Eventually the term Manufacturing Resource Planning II (MRP-II) was coined to identify the newer systems' capabilities. See Figure 12 below.

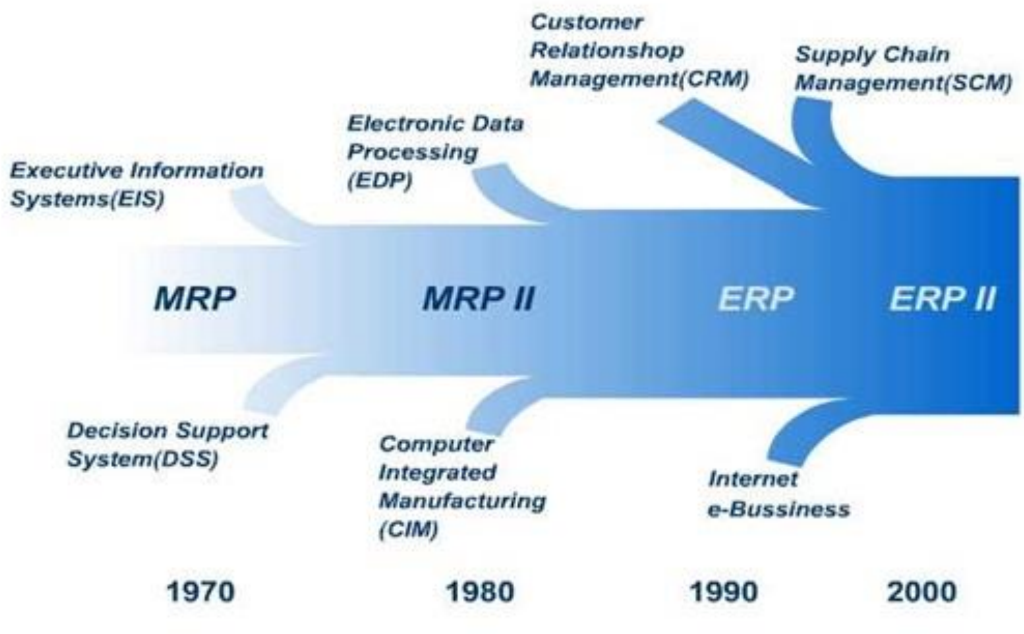


Figure 12: The Evolution of ERP. *Source: www.ahurn.com*

It has been noted that the term MRPII is in fact a misnomer, as it provided automated solutions to a wide range of business processes, not just those found within a company's manufacturing and distribution functions (Kalakota and Robinson, 2001). The transition from MRPII to ERP occurred between the 1980s and 90s. The basic MRP II system design was suffering from a number of inherent drawbacks, such as limited focus in relation to manufacturing activities and assumptions relating to the number of repetitive production set ups, along with poor budgetary and costing controls. MRP II included areas such as, shop floor and distribution management, project management, finance, human resource management and engineering control. In the early 1990s, it was the Gartner Group of Stamford, CT, USA, who coined the term ERP, to describe the software system that represented the latest developments of MRP II. Their definition of ERP included criteria for evaluating the extent that software was actually integrated both across, and within the various functional silos. What differentiated ERP from MRP II was the ability to extend the functionality beyond the traditional planning and scheduling of internal resources, to include the planning and scheduling of supplier resources based on real-time customer demands and schedules (Chen, 2001). During the 1990s, ERP suppliers provided more modules and functions as *"add-ons"* to the core modules giving birth to the *"extended ERP's"*. These ERP extensions included Advanced Planning and Scheduling (APS), e-business solutions such as CRM and SCM. An ERP system is, at its core, a pure software package; however, it embodies established methodologies of doing business. Studies have illustrated that an ERP system is not just a pure software package to be tailored to an organisation, but that it represents an organisational infrastructure that effects how people work, and that it imposes its own logic on a company's strategy, organisation and culture (Davenport, 1998c). An overview of ERP systems including some of the most popular functions within each module is illustrated in Figure 13. A typical system integrates all these functions by allowing its modules to share and transfer information by freely centralising information in a single database accessible by all modules (Chen, 2001).

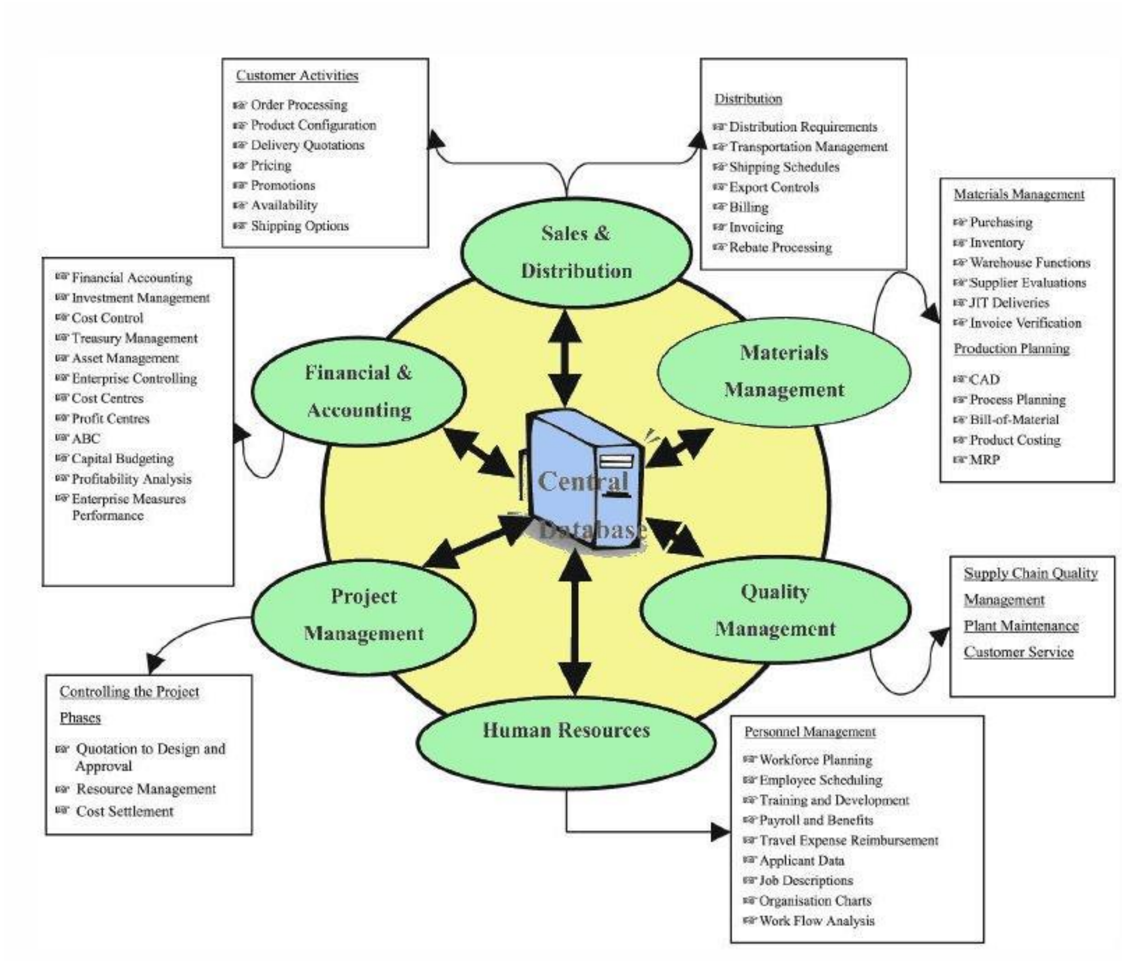


Figure 13: ERP System Modules: *Source: (Shehab et al., 2004)*

Within the manufacturing process, the application of MRP II led to the development of the Just-In-Time (JIT) methodology that became prevalent in the 1980s. One organisation that was truly able to demonstrate the benefits to be derived from such a system was Dell, and in the process, transformed itself into one of the most efficient SCM organisations across the globe. It went from a situation where, it was carrying up to 25 days of inventory across a complex network of distribution centres to a situation today, where it has no warehouses at all. Inventory time has been cut to 2 hours, with no component spending more than 24 hours across its entire operation. Components which it does not manufacture itself, such as the monitor and other peripherals *"meet up"* with assembled computers on their way to customers, and never enter into the manufacturing aspect of the supply chain. SCM techniques like these are only possible, by having a system in place that monitors supply and demand on a real-time basis, with the ability to implement immediate corrective actions when required.

2.2. Definitions

Many definitions have been proposed within the literature with respect to ERP, despite this fact, there is no agreement on an accepted definition. A formal definition provided by the American Production & Inventory Control Society (APICS) defines EPR as a:

"framework for organising, defining and standardising the business processes necessary to effectively plan and control an organisation, so the organisation can use its internal knowledge to seek external advantage." (Cox *et al.*, 1992)

However, this definition was later updated to state that ERP is:

"*An accounting oriented IS for identifying and planning the enterprise wide resources to take, make, ship account for customer orders.*" (Dembla, 1999)

ERP is primarily an Information and Communication Technology (ICT) driven philosophy. Within the IS literature, there are dissenting views on what exactly constitutes an ERP system. There are many diverse perspectives and (Klaus *et al*., 2000), note that it is unlikely that at this stage a broadly agreed definition of ERP can be achieved. Although there is no agreed upon definition for ERP systems, their characteristics position these systems as integrated, all-encompassing (Markus and Tanis, 2000), complex mega-packages (Gable *et al*., 1997) designed to support the key functional areas of an organisation. These definitions indicate that an ERP system is a generic term for an integrated enterprise wide standard IS (Watson and Schneider, 2001). Therefore, by definition, ERP is an operational-level system. Table 3 below lists a number of definitions that have been proposed within the literature.

ERP Definitions
An ERP system can be thought of as a company-wide IS that tightly integrates all aspects of a business. It promises one database, one application, and a unified interface across the entire enterprise (Bingi *et al*., 1999).
ERP systems are highly integrated enterprise-wide standard ISs (software packages) that automate core corporate activities (business processes) such as finance, human resources, manufacturing, and supply and distribution (Holland and Light, 1999a).
ERP is an integrated package of software applications designed to automate and integrate a company's business processes throughout its entire supply chain and to provide immediate access to business information. ERP systems can be thought of as wide ranging, general-

purpose Management ISs (MIS) for business (Maher, 1999).
ERP systems, a form of Enterprise-Wide IS (EWIS), represent sets of business applications that allow for an organisation-wide management of operations. ERP systems are seen as optimisation and integration tools of business processes across the supply chain (within and beyond organisational boundaries) implemented (Al-Mashari, 2000).
ERP is known as a large-scale, cross-functionally integrated, packaged system (Brown *et al*., 2000).
ERP systems are software packages that integrate information across the entire organisation. This integration removes inconsistencies and enables the organisation to attain consolidated reports (Shakir, 2000).
ERP is an integrated comprehensive Enterprise-Wide IS (Milford and Stewart, 2000).
ERP is a comprehensive Information Technology package built on the promise that all critical information should be totally integrated in a single information database (Wood and Caldas, 1999).
ERP links all areas of a company with external suppliers and customers into a tightly integrated system with shared data and visibility. ERP systems are designed to solve the problem of the fragmentation of information over many legacy systems in large business organisations (Chen, 2001).
ERP systems are comprehensive, fully integrated software packages that provide automated support for most of the standard business processes within organisations (Shanks *et al*., 2000).
An ERP system is a packaged business software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance, etc.) by providing a total, integrated solution for the organisation’s information-processing needs. It supports a process-oriented view of the business as well as business processes standardised across the enterprise (Nah *et al*., 2001).
ERP systems allow a company to share common data and practices across the enterprise and produce and access information in a real-time environment. These systems are designed to solve the fragmentation of information in large business organisations and to integrate information flow within a company (Themistocleous *et al*., 2001).
ERP plays a critical role in improving or reengineering out-dated infrastructures, gaining tighter control over internal operations, and driving down costs (Turban *et al*., 2001).
ERP consists of massive computer applications that allow a business to manage all of its operations (finance, requirements planning, human resources, and order fulfilment) on the

basis of a single, integrated set of corporate data (James and Wolf, 2000).
ERP systems are large and complex integrated software packages that support standard business activities (Oliver and Romm, 2000).

Table 3: ERP Definitions. *Source: (Sammon and Adam, 2004b)*

Along with the above, a number of professional organisations have proffered additional definitions. The Gartner Group defines ERP as follows:

"A collection of applications that can be used to manage the whole business, ERP Systems integrate sales, manufacturing, human resources, logistics, accounting, and other enterprise functions. ERP allows all functions to share a common database and business analysis tools."

Additional EPR definitions from Web sources include:

"An industry term for the broad set of activities supported by multi-module *application software that help a manufacturer or other business manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders.*" (Whatis.com)

ERP can also include application modules for the finance, and the human resources aspects of a business. Webopedia defines ERP as follows:

"A business management system that integrates all facets of the business, including planning, manufacturing, sales, and marketing."

All of these definitions identify ERP as a tool for business processes integration. They mention that ERP can integrate several business functions, such as sales, manufacturing, human resources, logistics, accounting, and other enterprise functions. The main difference among them is the role that ERP plays in corporate management. Some believe that ERP is used to manage the whole business process. However, other practitioners are of the opinion that ERP works for only the important parts of the business. For example, the Gartner Group along with other bodies support the concept that ERP integrates all facets of the business. The Gartner Group specifically points out that ERP allows all business functions to share a common database and business analysis tools. After comparing these different perspectives, it can be seen, that ERP is a set of highly integrated applications, which can be used to manage all the business functions within the organisation. ERP is comprised of a commercial software package that promises the seamless integration of all the information flowing throughout the company, including financial, accounting, human resources, supply chain, and customer information (Yen *et al*., 2002). Although there is some commonality in the above definitions, there are quite a number of key differences between them. Also, none of the above definitions mention the fact that ERP systems should support the strategic alignment of the organisation, and that this should be accomplished within a *"quality context"*. Taking these factors into consideration and combining the different perspectives, the author proposes a more holistic definition of ERP, which is:

"ERP systems are software packages that integrate information in order to support the strategic alignment and vision of the organisation within a quality framework."

The author is of the opinion that many organisations implement ERP solutions without having a clear understanding of how ERP can be implemented and aligned in order to support the strategic vision of the organisation, and also without a full understanding of how this should be performed within a *"quality context"*. ERP and TQM are both systems that have the potential to have a significant impact on business performance. ERP can be considered to be; an organisational planning and reengineering opportunity, as well as being a software application for tracking and controlling transactions. Specifically, an ERP system is an IT infrastructure that facilitates the flow of information between the processes of an organisation (Al-Mashari and Al-Mudimigh, 2003). In the same fashion, that IT should be looked upon as an enabler within the organisation structure, so it is with TQM, which should be seen in the role of an enabling structure that supports both the implementation and operational aspects of the ERP structure. The Internet has also brought about a revolution in supply chain thinking (Davenport and Brooks, 2004). TQM is a holistic philosophy of management that requires the organisation to continuously seek improvement in every activity, in every function, in every process. The observation has been made by (Klenz, 1999), that enterprise quality improvement is quite different from quality improvement at the process level, requiring information from many departments within the organisation. He argued that the disparity and disconnection of systems including ERP, manufacturing resource planning (MRPII), and statistical process control (SPC) systems, pose a major problem for the implementation of enterprise quality improvement (Laframboise and Reyes, 2005). An ERP system is a way of doing business (Davenport and Brooks, 2004), not merely a software package. Furthermore, ERP may be viewed as a top-level quality programme (Laframboise, 2002). Top-level quality programmes are initiatives that encourage the organisation to holistically seek process improvement, often drastically. In addition, (Bhatt, 2000), suggests that the use of integrated IT tools has proven to be valuable in providing opportunities for process standardisation, which may also be considered a goal of quality management. It has been suggested by (Kumar and Harms, 2004), that standardisation in a manufacturing or service environment may be achieved by identifying commonalities within operations, processes and services. The proper implementation of an ERP system requires a *"sequence"* of careful planning and implementation in conjunction with organisational catalysts for change like TQM. An organisation needs to assess the corporate culture and, should be prepared to restructure it if necessary, to a TQM culture (Braithwaite, 1994, Clark, 1999, Rampersad, 2001). The TQM concepts of, *"teamwork"* such as problem-solving teams, quality improvement teams, or cross-functional teams need to be implemented throughout the organisation in order to solve problems or to improve the problem solving capabilities both inside and outside of the organisation for purposes of change (Pike and Barnes, 1996, Rothwell and Kazanas, 1999). Although the focus of TQM is to drive small and incremental improvements, the TQM approach has been a powerful catalyst for change on productivity improvements of the organisation (Torok and Cordon, 2002). According to (Schniederjans and Kim, 2003), if an organisation's core business systems have an infrastructure that is ill prepared for the ERP changes necessary for system success, an integration project will fail no matter what types of ERP software packages an organisation decides to implement. The success of the integration project does not depend on the speed of the implementation or the amount of the capital investment. The extant literature suggests the success of the integration depends on how an organisation prepares itself for the quest of an integration programme. Change methods, such as Business Process Reengineering (BPR) and catalyst for change methods, like TQM, must be aligned to support the implementation of ERP.

2.3. Suppliers

BI systems can be either designed as custom applications or purchased as off-the-shelf standard solutions. The development of custom applications is generally expensive and is often plagued by uncertainties, such as the selection of appropriate development tools, the duration of the development cycle, or the difficulties involved in assessing costs. Therefore, companies are radically changing their information technology strategies by purchasing off-the-shelf software packages instead of developing IT systems in-house (Holland and Light, 1999a).

Three of the major players that currently dominate the market are SAP, Oracle, and PeopleSoft. Together they control more than 60 per cent of the global market. Each of these, due to a number of different historical reasons, has developed a particular specialty in one module area, such as, PeopleSoft in human resources management, SAP in logistics and Oracle within the financial domain. There are also about 50 established and a few more newly emerging smaller and midsize ERP vendors including third-party developers competing for the ERP market. This has resulted in stiff competition and feature-overlapping products which can be difficult to differentiate between. Due to keen competition for control of the lucrative ERP market share, the vendors are continuously updating their products and adding new technology-based features. Long-term vision, a commitment to service and support, flexible module features, specialty, experience and financial strength, along with research and development expertise are considered the major vendor qualities for product selection and implementation. Following, is a brief profile of the three major ERP Vendors.

SAP AG is the largest European software enterprise, with headquarters in Walldorf Germany. It was started by five former IBM engineers in Germany in 1972 with the intent of producing integrated business application software for the manufacturing enterprise (SAP, 2001). The acronym was later changed to stand for Systeme, Anwendungen und Produkte in der Datenverarbeitung *("Systems, Applications And Products in Data Processing")*. However, since 2005 the company's official name is just SAP AG. Its first ERP product, R/2, was launched in 1979 using a mainframe-based centralised database that was then redesigned as a client/server software R/3 in 1992. System R/3 was a breakthrough and by 1999 SAP AG had become the third largest software vendor in the world, and the largest in the ERP sector with a market share of about 36 per cent serving over 17,000 customers in over 100 countries. In 1999, SAP AG extended the ERP functions, by adding CRM, SCM, sales-force automation and data warehousing. SAP has also invested significantly in its R&D sector with the result of newer versions of R/3 3.1, 4.0, 4.6 including Internet functionalities and other enhancements. Towards the end of the 90s SAP announced the mySAP.com strategy, heralding the beginning of a new direction for the company and the product portfolio. mySAP.com links e-commerce solutions to existing ERP applications, using state-of-the-art Web technology. SAP has the broadest ERP functionality and the capacity to spend significantly on R&D. By 2005, 12 million people worldwide were working with SAP solutions. There are now estimated to be 100,600 installations worldwide, more than 1,500 partners, over 25 industry-specific business solutions, and more than 33,200 customers in 120 countries. SAP is the world's third-largest independent software vendor. In November, 2010, SAP lost a $1.3 billion intellectual property law suit to Oracle Corporation, cited as the largest software piracy judgment in history. SAP filed post-trial motions to lower the damage awarded to Oracle and stated it may also file an appeal. In September 2011, the verdict was overturned by Judge Phyllis J. Hamilton, who called the penalty *"grossly excessive."* In December 2011, SAP AG agreed to buy SuccessFactors Inc. for $3.4 billion in cash or 52 per cent more than the share closing price on 2 December 2011. With the acquisition, SAP AG will become more competitive with Oracle Corp. in the Cloud computing market. In May 2012, SAP AG announced that it was going to acquire the Sunnyvale, California-based supply chain network operator Ariba Inc. for an estimated $4.3 billion dollars. SAP said it will offer $45 a share. The acquisition is assumed to be completed in the third quarter 2012, subject to approval by Ariba shareholders and regulators

Oracle was established in 1977 with the intention of making relational database management systems (RDBMS) that could compete with the IBM System R database. The System R was the first system that was able to demonstrate RDBMS could provide a high transaction processing performance, and was the precursor of SQL, which has become the de facto industry standard querying language. It has offices in more than 145 countries around the world, and has over 50,000 employees worldwide. It is best-known for its database software and related applications, and it is the second largest software company in the world after Microsoft. Oracle's enterprise software applications started to work with its database in 1987, and now accounts for a significant portion of total revenues, which places Oracle second to SAP in the enterprise systems category with over 5,000 customers in 140 countries. Oracles ERP system is known as Oracle Applications, having more than 50 different modules in six major categories: finance, accounts payable, human resources, manufacturing, supply chain, projects and front office. Oracle has other strong products in the software field including Data Base Management System (DBMS), data warehousing, work flow, Systems Administration, Application development tools (APIs), and consulting services. A notable feature of Oracle is that it is both a competitor and a partner to some of the industry leaders in the ERP market such as SAP, Baan and PeopleSoft. This is because of the use of Oracle's DBMS in their ERP systems. Oracle has integrated its ERP solutions with the Internet and has introduced several applications in the electronic commerce and Internet-based commerce areas. Oracle's

Internet infrastructure is created around two powerful products: Oracle9i Database and Oracle9i Application Server. Another significant feature of Oracle is its OSBS, or Oracle Small Business Suite which provides consistent financials, payroll, inventory control, order entry, purchase orders, and CRM functionality, delivered as a Web service. Oracle also provides a Web presence that is relatively easy to utilise, that assists organisations to sell their goods using the Internet.

PeopleSoft was established in 1987 by Dave Duffield and Ken Morris, when they engineered the company's first human resources application. Built on client-server architecture, their solution offered flexibility and ease-of-use to a class of users previously barred from simplified access to the information and capabilities centralised in mainframe systems. Other functions include modules for manufacturing, materials management, distribution, finance, human resources and supply chain planning. SAP AG and Oracle, who have longer experience, stronger financial base and worldwide presence, are the main competitors to PeopleSoft. Many customers comment that PeopleSoft has a culture of collaboration with customers, which makes it more flexible than its competitors. One of the strengths of PeopleSoft is the recognition by its customers that it is flexible and collaborative. The flagship application PeopleSoft8 with scores of applications was developed by PeopleSoft with an expenditure of $500 million and 2,000 developers over two years as a pure Internet-based collaborative enterprise system. PeopleSoft with about 10 per cent market share is the third largest ERP vendor after SAP AG and Oracle. In June 2003, Oracle made a $13 billion bid in a hostile corporate takeover attempt. In February 2004, Oracle decreased their bid to approximately $9.4 billion; this offer was also rejected by PeopleSoft's board of directors. In December 2004, Oracle announced that it had signed a definitive merger agreement to acquire PeopleSoft for approximately $10.3 billion. Oracle has stated that it is committed to on-going maintenance and enhancements to the PeopleSoft application suite with its Application Unlimited programme, recently releasing PeopleTools 8.52.

The above listing only represents some of the key players in the field. For a more comprehensive listing of ERP and the range of products that they supply, please reference Appendix One.

2.4. System Selection

The system selection process can be deceptively difficult. While most ERP packages have similarities, they also have fundamental design differences. The selection involves listening to the views of various people whose involvement is essential, and the criteria to go beyond technical issues such as proven experience of the supplier in the desired industry, along with support infrastructure. Selecting a system that is relatively simple, and which offers smart tools for system administration, consistent interface, and supports graphical and character interfaces can assist in reducing the implementation time. The various selection criteria of ERP systems are well documented (Bernroider and Koch, 2001, Chen, 2001, Rao, 2000, Siriginidi, 2000, Sprott, 2000, Verville and Halingten, 2002, Van Everdingen *et al*., 2000). From the clients' view point, the selection factors to be considered, as addressed by (Siriginidi, 2000), include the stability and history of the ERP supplier, and the recent track record of ERP. A tremendous effort has been made in discussing the implementations of ERP systems. (Al-Mashari and Zairi, 2000b) proposed an integrative framework for SAP R/3 implementation. Their framework was based on the premise that effective deployment of SAP R/3 is greatly determined by the extent to which certain key elements such as the business case, implementation strategy, change management and BPR, are comprehensively considered and fully integrated.

Working on a proven methodology can reduce the actual implementation time, with partners and certified consultants who could be experts within their own speciality. In due course, ERP should enable an enterprise to use information as a means to gain increased competitive advantage by achieving the most effective practice in the industry. This group of factors, concerns moving from the *"what"* to the *"how"* issue of implementation, and converting the initial ideas into real actions, that focus on the value chain aspects. From a business perspective, the deployment stage, includes the definition of the documentation, analysis, improvement, control and redesign/reengineering opportunities of all the most critical processes and core activities. These activities are coupled with the management of the people, and change management, which deals with issues, such as, preparing the organisation for change, dealing with resistance, establishing communication, awareness channels; teambuilding, and the use of tools and techniques for problem solving, along with project-management competencies (Al-Mashari *et al*., 2001).

2.5. Evaluation

Measuring and evaluating performance is a very critical factor for ensuring the success of any business organisation and indeed for making IT systems such as ERP pay back. Performance management in this context is therefore an integrated holistic concept. It has to embody the whole organisation and capture tangible and intangible aspects, cover soft and hard elements and include aspects of synergy through integration. The case is made by (Sinclair and Zairi, 2000), that such measurement is not widely pervasive as an integrated practice, and its implementation is not a straightforward process. It is suggested, that measurement takes place in a balanced perspective, and for the purpose of providing useful information that can enable the decision making process and, which can help deliver the corporate objectives and therefore, lead the business competitively forward. In ERP contexts, the performance management has got to reflect a holistic and balanced perspective. In addition to technical performance such as reliability of the system, other aspects on flexibility, speed, timeliness, costs, etc. can also be added on. The value-added contribution is in the form of the tangible and intangible benefits, covering the strategic and operational aspects of business organisations. This aspect of realising value through the intangible aspects of the benefits that ERP systems confer will be further discussed later within the thesis.

Competitive measurement covers the added capability provided by ERP systems to the organisation, as well as to the business of stretching the competitive and strategic agenda. In order to ensure that the system produces the results intended, regular auditing and benchmarking activities should be undertaken in order to ensure optimisation of the potential that is available to the various aspects of the businesses. In addition, external benchmarking can bring in new ideas, knowledge and best practices on dealing with deficiencies in ERP systems, such as; identifying bottlenecks, streamlining process, optimising and redesigning for more extensive benefits (Al-Mashari, 2002). Such audits can take advantage of an array of existing tools that can be applied to scan both the organisational, managerial and technical sides of the business. Appendix Two contains a representation of a detailed checklist based on research conducted by (Kale, 2000), that can be used gather relevant information that can be analysed and used as the basis for the selection process. The task of evaluating different ERP systems is greatly simplified through the use of detailed checklists. This makes it possible to compare all the relevant details in relation to each system, which can then be analysed and used as a valuable reference when deciding which of the many possible vendors to choose from. This is quite an extensive checklist and the main selection criteria are identified as follows:

- Vendor issues.
- Product Issues.
- Technical Issues.
- Installation and operation issues.
- Integration and Interface issues.
- Modification and maintenance issues.
- Audit and control issues.
- Standards and documentation.

2.6. Life Cycle

The implementation of Commercial Off The Shelf software (COTS) ERP systems is an area that is suggested to have a life cycle of its own (Peslak *et al*., 2008), which is distinct from the implementation of specific IT applications. ERP implementations have the ability to impact on the broad organisational transformation processes, with significant implications on the organisation’s management model, structure, management style and culture, and particularly, on people (Caldas and Wood, 1999), and as (Davenport, 1998c), notes, ERP systems are not projects that someday will end, but rather, they are a way of life that continues into the future. They require a high degree of alignment between business strategies, IT strategies and organisational processes (Gibson *et al*., 1999), in a similar vein (Henderson and Venkatraman, 1991), make the point that, for more general enterprise IS, change seems to be the main phenomenon associated with an ERP system. According to (Jarke and Pohl, 1994), in order to deal with change effectively, one has to establish the change vision in the given technical, social, and organisational context. The research issues have been mapped by (Esteves and Pastor, 1999), that can be analysed in the ERP life-cycle process using the framework as illustrated in Figure 14. In the diagram, phases represent the different stages of an ERP system life-cycle within an organisation and dimensions are the different viewpoints by which the phases can be analysed. The phases of the ERP life-cycle are comprised of the different stages that an ERP system goes through during its whole life within the hosting organisation, which consist of the following: adoption decision phase, acquisition phase, implementation phase, use and maintenance phase, evolution phase and retirement phase.

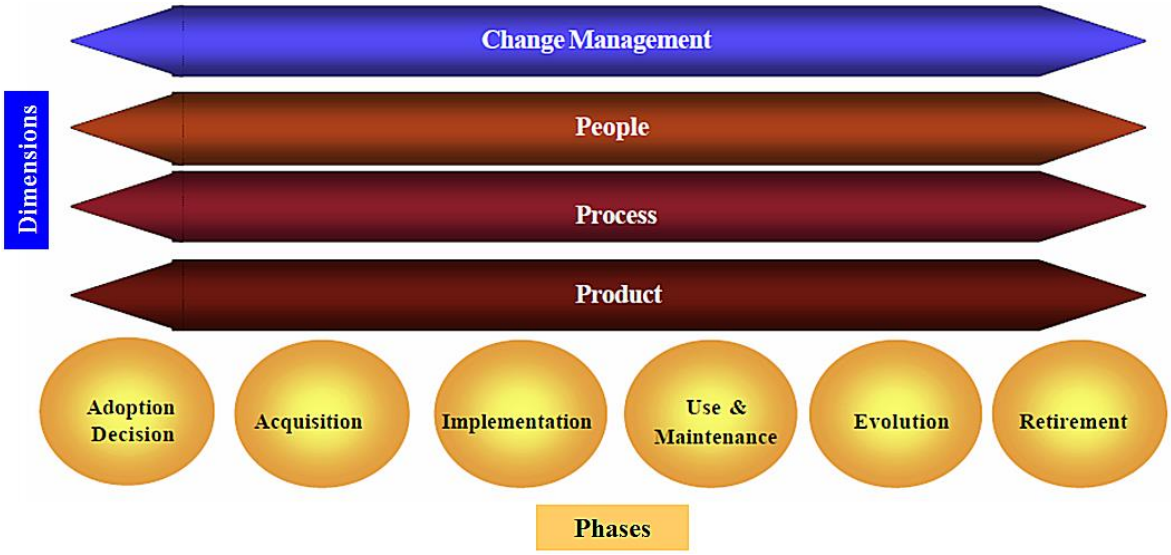


Figure 14: ERP Life-cycle Framework. *Source:(Esteves and Pastor, 1999)*

A brief description of each phase is provided, as follows;

Adoption decision phase: This phase is the one during which managers must question the need for a new ERP system while selecting the general IS approach that will best address the critical business challenges and improve the organisational strategy. This decision phase includes the definition of system requirements, its goals and benefits, and an analysis of the impact of adoption at a business and organisational level.

Acquisition phase: This phase consists of the product selection that best fits the requirements of the organisation, thus, minimising the need for customisation. A consulting company can also be utilised to assist within the different phases of the ERP life-cycle especially in the implementation phase. Factors such as price, training and maintenance services are analysed and, the contractual agreement is defined. In this phase, it is also important to make an analysis of the return on investment of the selected product.

Implementation phase: This phase consists of the customisation or parameterisation and adaptation of the ERP package acquired according to the needs of the organisation. Usually this task is made with the help of consultants who provide implementation methodologies, know-how and training.

Use and maintenance phase: This phase consists of the use of the product in a way that returns expected benefits and minimises disruption. During this phase, one must be aware of the aspects related to functionality, usability and adequacy to the organisational and business processes. Once a system is implemented, it must be maintained, because malfunctions have to be corrected, special optimisation requests have to be met, and general systems improvements have to be made.

Evolution phase: This phase relates to the integration of more capabilities into the ERP system, providing new benefits, such as advanced planning and scheduling, supply-chain management, CRM, workflow, and expanding the frontiers to external collaboration with other partners.

Retirement phase: This phase corresponds to the stage when with the appearance of new technologies, or the inadequacy of the ERP system or the approach to the business needs to be altered. Managers must decide if they will substitute the ERP software with another IS approach that more adequately represents the needs of the organisation.

Dimensions of the ERP Life-cycle: The four dimensions of the ERP life-cycle are: product, process, people and change management.

Product: This dimension focuses on aspects related to the particular ERP product in consideration, such as functionality, and on related technical aspects, such as hardware and base software needs. A thorough understanding of the software tool's capabilities must exist in order to make an alignment with the business strategy in order to determine whether the software is being used effectively, in accordance with the needs of the organisation, and how it can best be applied to further the goals of the organisation.

Process: Each organisation has its own core capabilities and functionality that must be supported by an ERP system. Also, an ERP system must help the decision making required to manage the resources and functions of the organisation. Usually, the main ERP investment focus is on reengineering processes to enable the organisation to adapt to the new business models and functional requirements of the ERP system in order to achieve better performance.

People: This dimension refers to the human resources and their skills and roles in an ERP system life-cycle. These skills and roles must be developed to minimise the impact of the introduction and diffusion of an ERP system, in order to reduce risk and manage complexity, while facilitating organisational change. Dealing with contingencies, changing practices, and adapting to a new organisational structure and culture are some aspects that must be learned.

Change management: This dimension refers to the body of knowledge that is used to ensure that a complex change, like that associated with a big system, gets the right results, in the right timeframe, at the right costs (Holland and Davis, 1998). The change management approach tries to ensure the acceptance and readiness of the new system, allowing the organisation to get the benefits of its use.

2.7. Implementation

ERP implementation should involve the analysis of the current business processes and the probability that reengineering will be required, rather than designing an application system that makes the best of an existing poor process. Therefore, ERP implementation and BPR activities should be closely connected. In principle, it would be always better to carry out BPR in advance of ERP. Pragmatically, it may not be easy to do so because BPR is effort intensive, and costs money and time. Also, carrying out BPR in advance of ERP implies that the enterprise needs to put resources into two successive projects. In addition, customisation of the software should be kept to an absolute minimum and should be avoided, if at all possible. ERP packages offer many best business practices that might be worth including as a part of BPR (Gulla and Brasethvik, 2002). After the ERP implementation, one could get into continuous process reengineering. Several enterprises may have different primary objectives in implementing ERP. They would probably fall in one of the following: standardisation of objectives, elimination of organisational and technical bottlenecks, improvement in quality of information, replacement of out-of-date procedures and systems, integration of business processes, reduction in stand-alone systems and interfaces, and covering areas previously neglected. The objectives and the corresponding expectations should be clearly documented (Siriginidi, 2000). The general steps involved in the ERP implementation process are outlined in Figure 15.

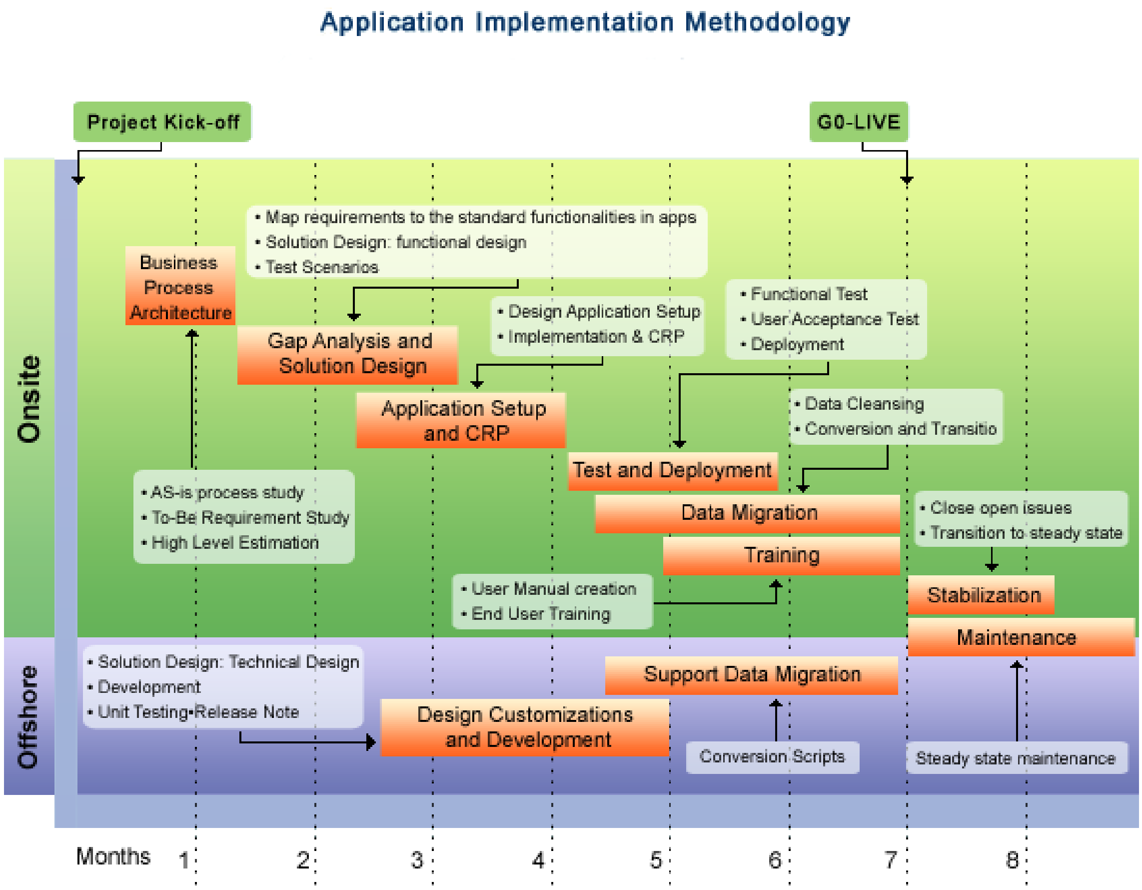


Figure 15: Application Implementation Technology. *Source: (IndiaLGCNS, 2011)*

In an exploratory survey conducted (Wood and Caldas, 1999), in relation to ERP implementation, it was found that 71 per cent of the companies in the survey admitted that implementation followed reengineering or was conducted simultaneously with reengineering. However, 24 per cent of the firms affirmed that the implementation process was focused on its human side and its transformational dimension, while 36 per cent of companies confirmed that the implementation process was more heavily focused on IT. An empirical investigation of the reality of ERP system implementations in Irish organisations has been carried out by (Adam and O Doherty, 2001), where they focused specifically on the profiles and sizes of the organisations implementing ERP and on the key parameters in their relationship with their suppliers of ERP software. They found that the ERP implementations in Irish organisations are different to the projects that have been reported elsewhere in two key respects. First, the organisations interested in ERP software were, on average, far smaller than the case studies reported in the literature and the majority of the cases they reviewed were, Small to Medium Enterprises (SME’s). Second, the duration of implementation was far shorter than that reported elsewhere. These results are not surprising if one considers the smaller average size of Irish organisations, but they indicated that the ERP movement is truly ready for an extension towards the SME market. They also indicated that the duration of the implementation of ERP software may be related to the size and complexity of the client organisation and that SME's can expect to have a better time implementing ERP's than the current literature suggests. They also found that software implementers play a key role, not only in technical terms but also in managerial and political terms, because they can help their clients in correcting their expectations and perceptions of ERP systems and implementations. The essential knowledge required for ERP software implementation in SME's has been identified by (Chan, 1999), and he proposes a framework for inter-relating the various areas of knowledge. The framework comprises three dimensions: the project management, the issues, and the technical knowledge dimensions.

Many academic papers deal with integration between ERP and advanced planning systems, or advanced planning and scheduling systems. Some of them have extended the integration to, other software components, like Manufacturing Execution System (MES), Warehouse Management Systems (WMS), and Transportation Management Systems (TMS). The general goal of this integration is to make the decision-making processes easier, and (Liu *et al*., 2002) address the system integration of an Advanced Planning and Scheduling (APS) system with ERP and MES. They propose an integration model structure and, they have illustrated it by the system integration mechanism taking into account the required frequency of data integration and different approaches of data transfer, and along with this (Chen and Chen, 2005), develop a tactical-level decision model that solves the production-scheduling problem, which is similar to sales and operations planning. Recently, researchers have turned their attention to the contribution of ERP systems to supply chain coordination, when the supply chain is composed of several legal entities: in virtual enterprises or in an international context, and (Akkermans *et al*., 2003), have studied the future impact of ERP systems on supply chain management. One of their main findings was that they saw only a modest role for ERP in improving future supply chain effectiveness and a clear risk of ERP actually limiting progress in SCM. ERP was seen as offering a positive contribution to only four of the top 12 future supply chain issues. Moreover, they identified key limitations of current ERP systems in providing effective SCM support. (Kelle and Akbulut, 2005), argue that even if ERP software provides different tools that can support supply chain integration, at the same time it has several features that prevent the integration with business partners. The author is of the opinion, that this negative perspective was influenced by the first generation of ERP products which had been designed to integrate the various operations of an individual firm, whereas in modern SCM, this has changed considerably to include a network of organisations. Virtual and extended enterprises have been studied by (Kovács and Paganelli, 2003). These are enterprises, which are distributed in space and which are composed of temporary joint ventures of legally different units, and they propose a complex, Web-based solution to manage large, expensive, multi-site, multi-company projects

Using a case study method that involved the direct observation and systematic interviews at five US and Taiwanese manufacturing firms, (Yen and Sheu, 2004), identified two other variables; national culture, and government and corporate policies, as being critical to ERP implementation in multi-national settings. New methods are also suggested for identifying critical implementation steps, like (Somers and Nelson, 2003), who use a probabilistic description to identify which activities associated with the various steps of the ERP implementation are important. They note that some key aspects like training, communication, or the role of the steering committee, had not been fully taken into account during the whole life-cycle of the implementation. Decision-support tools were also recommended for persons who were charged with the implementation process, with the aim of collecting information and interacting with users in order to facilitate ERP implementation. The most suitable implementation process according to the characteristics of a company is the central idea of several articles; for instance, (Mabert *et al*., 2003) argue, on the basis of case studies in the US, that the implementation method should depend on the size of the company, or (Parr and Shanks, 2000), who suggest a taxonomy of ERP implementation categories. Along with these, (Wu and Wang, 2003), focus on the industry size and industrial sector to compare their difference in implementation, whereas (Huin, 2002), specifically address the implementation of ERP systems in South East Asian SME’s.

2.8. Deployment

ERP packages touch many aspects of a company's internal and external operations. Consequently, successful deployment and use of ERP systems are critical to organisational performance and survival (Markus *et al*., 2001). Potential benefits include drastic declines in inventory, breakthrough reductions in working capital, abundant information about customer wants and needs, along with the ability to view and manage the extended enterprise of suppliers, alliances and customers as an integrated whole (Chen, 2001). In the manufacturing sector, ERP implementation has reduced inventories anywhere from 15 to 35 per cent (Gupta, 2000). Among the most important attributes of ERP (Nah *et al*., 2001, Soh *et al*., 2000), are its abilities to: automate and integrate business processes across organisational functions and locations; enable implementation of all variations of best business practices with a view towards enhancing productivity; share common data and practices across the entire enterprise in order to reduce errors; and produce and access information in a real-time environment to facilitate rapid and better decisions and cost reductions. The deployment of ERP has two main components; selection and implementation.

ERP systems are derived from a true business need and requirement, their purpose is clearly defined through the IT vision and mission, and their role is to support all aspects of process management. Companies often fail to consider whether the system they are evaluating will match their overall business strategy (Davenport, 1998c, Davenport, 1998b). It is therefore, prudent that the characteristics of ERP software match the criteria used by an organisation to select an IS. The results of a survey of the criteria used by organisations in selecting their current IS, shows that the best fit with current business procedures is the most important one (Van Everdingen *et al*., 2000). Clarkston Potomac (Computer Technology Research Corporation, 1999) suggests several practices to ensure a successful ERP selection process, including staying on schedule, including human resources representatives in the assessment of IT capabilities, and not allowing vendors to drive the agenda of the presentations that they give. It is important to communicate the requirements of the organisation very clearly, to potential vendors. A part of the evaluation process, should include building test scenarios that represent current and future processes, these should document the capabilities that the ERP system will be expected to accomplish. All conclusions reached about each vendor, should be recorded for future reference, while respecting dissenting options. With the use of experienced personnel, it should be possible to eliminate clear losers immediately, while maintaining site of the original objectives, and (Rao, 2000), believes that small and medium enterprises should check for five important criteria when selecting an ERP package. These are affordability, domain knowledge of suppliers, the level of local support, software upgradability and use of latest technology. As the deployment of such an extensive system is closely related to people's daily work, resistance to change and change management strategies need to be considered.

The risks have been assessed in ERP projects by (Huang *et al.*, 2004b), by interviewing members of the Chinese Enterprise Resource Planning Society, and they prioritised the top ten risk factors based on factor analysis. According to the results of this research, soft factors such as senior management commitment to the project, communication with users, training and user support present the key risks. Planning actions for each risk factor require the management of change, and in this context (Aladwani, 2001), suggest a three-step process-oriented change management approach, which consists of the phases of knowledge formulation, strategy implementation, and status evaluation. From the technical point of view, the key choice in ERP implementation is to find an optimal strategy to balance between customisation of the ERP system versus changing the organisational procedures within the company (Huang *et al.*, 2008, Lui and Chan, 2008). From the organisational point of view, it is to manage change and develop the business processes. These two views are merged in many deployment projects. Despite extensive use of software vendors and business process consultants, the impact of their role has not been studied widely. Software vendors can be also blamed for non-successful implementation, but since changing human organisation and processes are often beyond the control of people coming from external organisations, these opinions should be interpreted with a certain level of scepticism.

2.9. Optimisation

Until recently, nearly all the literature on ERP was focused on ERP programmes and ERP implementation, although the post-implementation phase had been identified, very little attention has been paid to the real return on investment of such big programmes. How to define a successful ERP project? IT professionals generally talk about success when the project achieves its budget and targets and when the new IS *"works"*. In reality, success is achieved when the organisation is able to better perform all its business processes and when the integrated IS can support the performance development of the company. There is a small but growing range of literature on the impact of ERP systems on performance and productivity of organisations. Directions of research which address the post-implementation or optimisation phase are; the user's satisfaction or ERP usefulness, the benefits to be derived and the advantages that firms can gain from ERP (Botta-Genoulaz *et al*., 2005). The maintenance activity can be considered as one aspect of the optimisation. Similar to traditional IS ERP systems must be maintained and upgraded. Yet, very few authors have focussed on the ERP maintenance activities, though (Ng *et al*., 2002), have addressed this issue. From a case study of a large organisation that implemented ERP, distinctions within the maintenance activities were observed, and as a result a benefits-oriented taxonomy was proposed, that, better represents ERP maintenance activities, including ERP enhancement. More generally, (Nicolaou, 2004), have examined the process of system review during the post implementation stage of an ERP implementation. From two case studies, he defines a construct of Post Implementation Review (PIR) quality, that could be used to re-examine performance relationships and more completely interpret their results, or lack thereof, according to the extent to which organisations engage in high-quality PIRs (Nicolaou, 2004).

Information technologies cannot by themselves influence the productivity of a company. The main efficiency factor lies in the way people use these technologies. Many information strategies have failed because the significance of this critical issue was not clearly understood. It is proposed by (Orlikowski and Barley, 2001), that the transformations that are currently occurring in the nature of work and organising, cannot be understood without considering both the technological changes and the institutional contexts that are reshaping economic and organisational activity. Similarly, user satisfaction is one evaluation mechanism for determining system success, and (Wu *et al*., 2002), conducted a survey to identify user satisfaction patterns: they identified several areas of low ERP satisfaction, like feelings of user involvement, system understanding, or system integrity. This aspect is also studied by (Calisir, 2004), who from 51 end-users in 24 companies examines various usability factors affecting end-user satisfaction with ERP systems; their results indicates that both perceived usefulness and learnability determine the end-user satisfaction. ERP systems represent complex managerial tools, and a technology that requires the multi-disciplinary attention of operations management, IS, finance, marketing, organisational behaviour, and human resources fields (Sarkis and Sundarraj, 2003). This is confirmed by (Botta-Genoulaz *et al*., 2005), who make the point that, since 1997, half of the research publications in management and business journals include *"enterprise resource planning*" in their abstracts. In a comprehensive survey conducted on behalf of Deloitte Consulting in 1998 by

Benchmarking Partners, Inc, an industry analysis, consulting, and software firm based in Cambridge, Massachusetts, a number of significant findings were observed. The survey consisted of in-depth interviews with 164 individuals at 62 Fortune 500 companies. Of these organisations, 88 per cent have $1 billion or more in revenues, with only four per cent below $500 million. At that time, the companies represented the two industries that were farthest along in their implementation of ERP programmes: manufacturing and consumer business. All of them used one of the four predominant ERP solutions: Baan, Oracle, PeopleSoft or SAP.

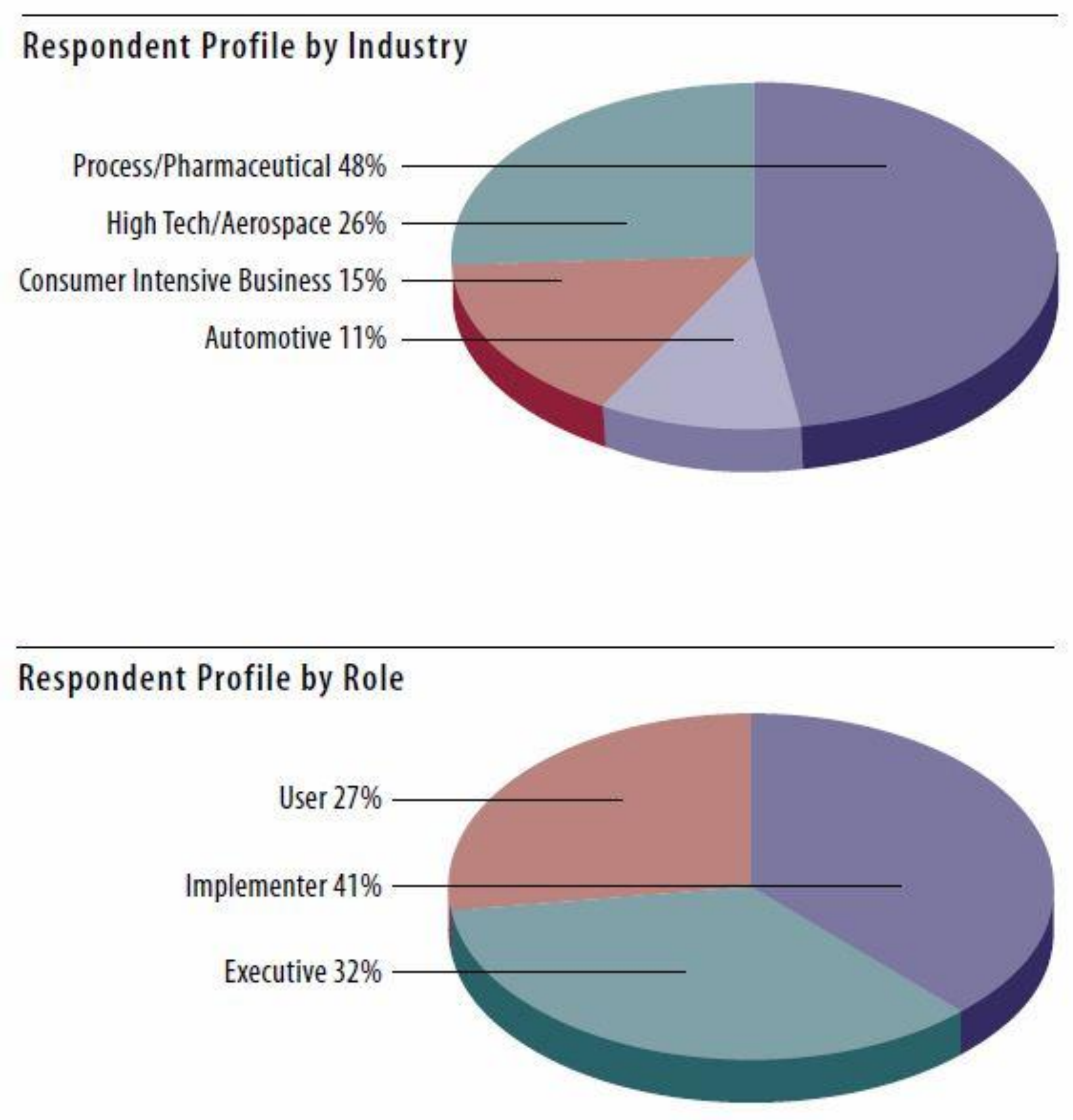


Figure 16: Respondents Profile by Role and Industry. *Source: (Deloitte, 1998)*

The survey data was complemented by information from a variety of other sources, including on-site case interviews, partner focus groups, and successful post-implementation engagements (Deloitte, 1998). A complete description of the questions posed in the survey and the answers provided by the respondents is provided in appendix Three. To achieve a balanced perspective, Benchmarking Partners interviewed three distinct groups of people within organisations: implementers (41 per cent, typically the project director); users (27 per cent, often vice-president of operations); and executives (32 per cent, usually the CEO or COO). See Figure 16.

The findings from this survey indicate that there are clear benefits to be derived from ERP programmes. Chief among these are the technological benefits that can be derived, but there was also a clear realisation of operational issues which could be addressed. The overall goal of the exercise being that of achieving improved quality, and visibility of information within the organisation. Cost reduction was seen as a primary objective, which was to be achieved through reductions in personnel, followed by inventory and IT costs. There was a division between those who took a view of ERP programmes having a definite completion date, and those who tended to have a longer term perspective, and tended to see ERP as extended and on-going programmes. It was also interesting that within the survey, many respondents did not see ERP as an all-embracing solution, and they could see the need for complementary solutions through the use of alternate technological solutions. Concerns surrounding *"People Issues"* were clearly identified despite the emphasis upon the technology aspects within an ERP programme.

2.10. Competitive Advantage

Much of the early research on the relationship between technology and productivity used economy-level or sector-level data and found little evidence of a relationship. For example, (Roach and Stanley, 1987), found that while computer investment per white-collar worker in the service sector rose several hundred per cent from 1977 to 1989, output per worker, as conventionally measured, did not demonstrate a great increase, and (Solow, 1987), summarised this kind of pattern in his well-known remark; *"You can see the computer age everywhere except in the productivity statistics."* However, by the early 1990s, analyses at the firm-level were beginning to find evidence that computers had a substantial effect on firms' productivity levels. Using data from over 300 large firms over the period 1988-92, (Brynjolfsson and Hitt, 1995, Brynjolfsson and Hitt, 1996), estimated production functions that use the firms' output as the dependent variable and include ordinary capital, information technology capital, ordinary labour, information technology labour, and a variety of dummy variables for time, industry, and firm. The pattern of these relationships is summarised in Figure 17, which compares firm-level IT investment with multifactor productivity (excluding computers) for the firms in the (Brynjolfsson and Hitt, 1995) dataset. There is a clear positive relationship, but also a great deal of variation in individual firms' success with information technology.

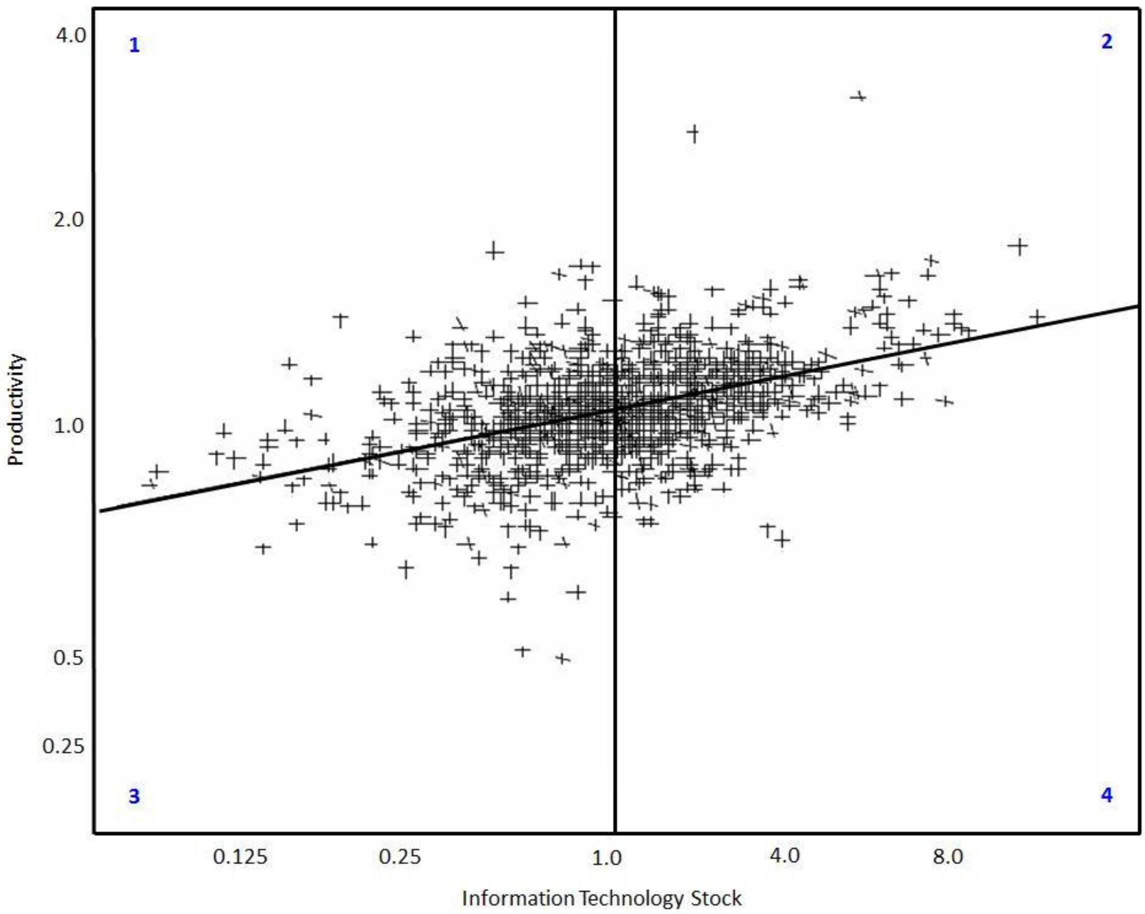


Figure 17: Productivity V Information Technology Stock. *Source: (Brynjolfsson and Hitt, 1995)*

An awareness of the organisational and managerial dimensions of IS can assist management in understanding why some firms achieve better results from their IS than others. With reference to Figure 17, it can be seen that some firms invest a great deal and receive a great deal (quadrant 2), while others invest an equal amount and receive fewer returns (quadrant 4). Still other firms invest little and receive much (quadrant 1), whereas others invest little and receive little (quadrant 3). This suggests that investing in IT does not by itself guarantee good returns, and that IT investments alone can't make organisations and managers more effective unless they are accompanied by supportive values, structures, and behaviour patterns in the organisation and other complementary assets. Recent research on business IT investment indicates that firms that support their technology investments with investments in complementary assets, such as new business processes, management behaviour, organisational culture, or training, receive superior returns, whereas those firms failing to make these complementary investments receive less or no returns on their IT investments (Brynjolfsson and Brown, 2005, Brynjolfsson and Hitt, 2000).

One of the major motives of ERP implementation is to provide an organisation with a sustained competitive advantage. Unfortunately, the examination of existing research suggests that this is not always the case. According to (Beard and Sumner, 2004), failure to achieve a competitive advantage is due to the *"common systems"* approach used for the implementation of most ERP systems. They argue that this goal can only be achieved with a careful planning and successful management of ERP projects, refinement of the reengineering of the organisation, and the post-implementation alignment of the ERP system with the organisation's strategic direction. From a study of five manufacturing firms, (Yen and Sheu, 2004), have investigated the relationship between ERP implementation practices and a firm's competitive strategy, and confirm that ERP implementation should be aligned with competitive strategy, proposing specific guidelines, and (Hunton *et al*., 2003), have examined the longitudinal impact of ERP adoption on firm performance by matching firms that had adopted ERP with firms that had not. Their results indicate that return on assets, return on investment, and asset turnover were significantly better over a 3-year period for adopters. Their study findings shed new light on the productivity paradox associated with ERP systems and suggest that ERP adoption helps firms gain a competitive advantage over non-adopters. ERP makes possible deep changes in relationships, culture, and behaviours that can be crucial sources of advantage in the knowledge economy, but the structures and cultures most able to achieve this level of change can be a poor fit with ERP requirements. To reconcile this paradox, (Lengnick-Hall *et al*., 2004), propose that ERP should be considered as an enabling technology to build and augment social and intellectual capital, rather than as an information technology solution for organisational inefficiencies, and to use ERP as a foundation for social and intellectual capital formation. Figure 18 illustrates three phases of competitive advantage which can be obtained through the implementation of ERP.

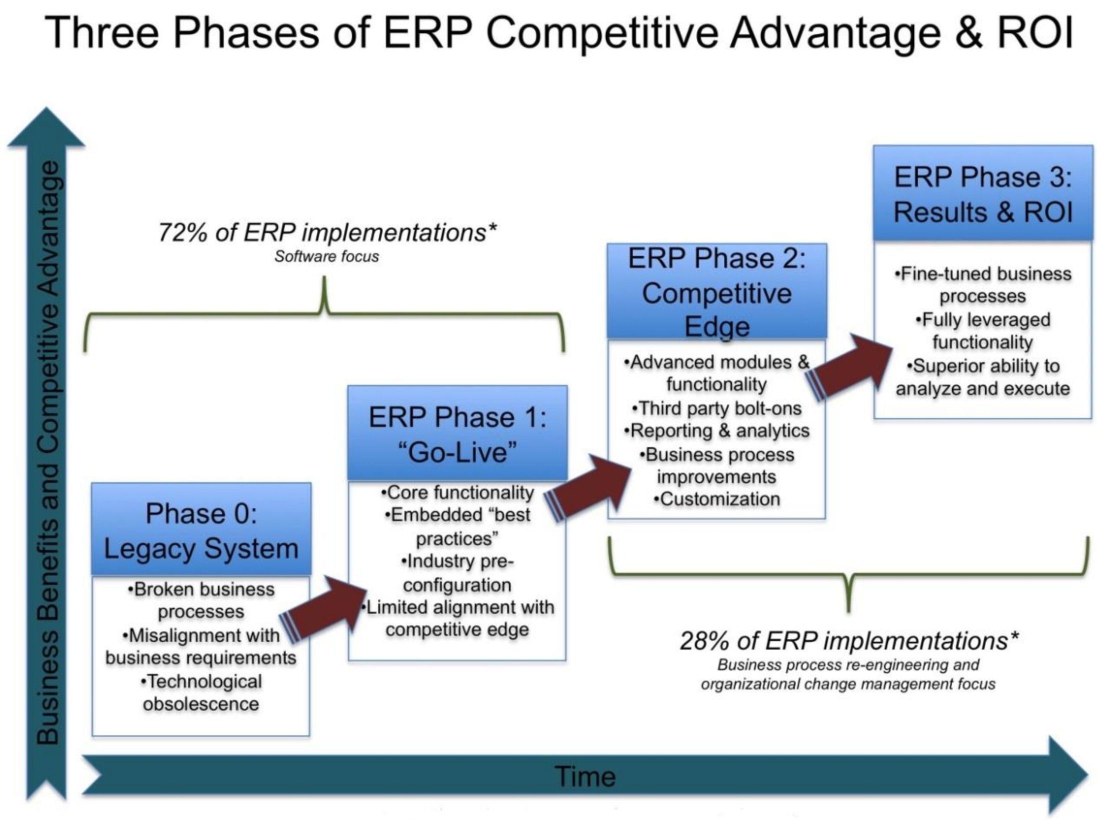


Figure 18: Three Phases of Competitive Advantage. *Source: Panorama Consulting Solutions*

However, contradicting the claims, that ERP software is a probable source of competitive advantage, (Carr, 2004), argues strongly that IT has become a commodity, and therefore that investments in IT are unlikely to be sources of competitive advantage. Following Porter (Porter, 2001b), he argues that competitive advantage comes from providing a unique value proposition for some group of customers. *"Competitive strategy is about being different."* (Porter, 2002). Further, he argues that although transformative technologies such as railways and electricity were initially drivers of massive structural shifts in industry, and therefore, sources of competitive advantage for some years (because they enabled some firms to strategically position themselves to use the new technology in new ways that led to superior profitability), organisations around the world have now adapted to those technologies and they are no longer sources of competitive advantage. Thus, whilst we are still absolutely dependent on, for example, electricity, few people today would regard electricity as a source of competitive advantage and so superior profitability. When first published in the May–June issue of *Harvard Business Review*, 2003, Carr's argument that IT was unlikely to be a source of competitive advantage, provoked a torrent of letters to the editor of the Review. Chief Information Officers (CIOs) in large organisations around the world were alarmed because

Carr's arguments challenged the key argument that they used to justify their IT budgets. IT industry leaders took strong, if predictable, positions opposing Carr: *"Hogwash",* said Steve Ballmer, CEO Microsoft, and *"dead wrong"* said Carly Fiorina, then CEO, Hewlett-Packard (Carr, 2004). Within academia, (Tapscott, 2004), came to the conclusion that Carr was wrong, whilst (Varian, 2004), a respected Berkeley economist, concluded *"It is not information technology itself that matters, but how you use it".* Applying Carr's argument to ERP, one might argue that ERP systems have now been widely available for over a decade, so that the firms most likely to be able to benefit most from the increased integration, information transparency and process efficiency enabled by such systems have had ample time to implement ERP systems and adjust their work practices. Thus, the potential competitive advantages from ERP (if they ever existed) are most likely to have already been competed away. Therefore, ERP is an unlikely source of competitive advantage in organisations today (Seddon, 2005).

There is a view now that, the adoption of ERP systems has peaked, and it can be observed from the various vendor financial statements that, the sales of new systems have declined rather sharply since 2000. For example, the income stream of SAP has altered, so that they are now deriving 50 per cent more revenue through their annual maintenance charges than through sales of new software licences. Similarly, Oracle's takeover offer for PeopleSoft can be understood best as a bid by Oracle to purchase a stream of maintenance revenue for the foreseeable future. As with Carr's arguments about electricity, the argument that ERP systems are not a source of competitive advantage does not imply that ERP software is not important, it is. If implemented and managed appropriately, ERP software can be an important source of operational effectiveness. Further, as Porter has argued, operational effectiveness is an important requirement for obtaining *"superior organisational performance"* (Porter, 2002). However, like electricity, a technology may be critical to a firm's operations, yet not a source of competitive advantage. The author agrees with Carr, that, when other factors are equal, ERP systems do not necessarily represent a source of competitive advantage for firms today. It should be kept in mind however, that for those organisations who decide not to take advantage of the capabilities, that an ERP system can confer, they do run the risk of operating at a serious disadvantage compared to their competitors.

While companies such as Cisco Systems, Eastman Kodak, and Tektronix have been able to demonstrate the benefits that can be obtained from the correct implementation of ERP systems, many businesses are discovering that their ERP implementation has not produced anything like the outcomes that were required and desired. In 1996, FoxMeyer Drug, a $5 billion drug distributor, declared bankruptcy after failing to implement an ERP system over a three-year period. FoxMeyer sued SAP, the world's leading supplier of ERP software, for $500 million, stating that its system was a *"significant factor"* that brought about the company's financial ruin (this despite the fact that FoxMeyer only spent $30 million dollars on the ERP programme) (Davenport, 1998c). FoxMeyer argued that major problems were generated by a failed ERP system, which created excess shipments resulting from incorrect orders and costing FoxMeyer millions of dollars (Bicknell, 1998). Mobil Europe invested many millions of dollars in an ERP system only to abandon it as a result of objections by its merging partner (Davenport, 1998c). Unisource Worldwide Inc. wrote off $168 million in costs when it abandoned its Pan-American implementation of SAP software (Bingi *et al*., 1999). Dell Computers, after months of delay and cost overruns, abandoned their ERP project, because they found that the new system was not appropriate for its decentralised management model (Stefanou, 2000). An interesting question that was posed by (Stewart, 2000), that appears not to have been addressed within the literature, when comparing the failure of FoxMeyer to that of Dell, is; why the failure in FoxMeyer led to bankruptcy, while the failure in Dell, was nothing more than a financial embarrassment. Other ERP failures also include Boeing, Dow Chemical, Applied Materials, Hershey, and Kellogg's. A recent study indicates that 40 per cent of all ERP installations only achieve partial implementation, and 20 per cent of attempted ERP adoptions are scrapped as total failures (Trunick, 1999).

Depending on the definition of failure, other studies have suggested that ERP failure rates may even be greater than 50 per cent (Escalle *et al*., 1999). All of these figures pale into insignificance compared to the €10 Billion programme by the British National Health Service (NHS) to create a single network that would allow NHS staff across England to *"access any patients"* details. After already spending €3 billion on the programme, the NHS announced that it has been unable to demonstrate, what benefits have been delivered from the monies spent on the project so far. The integrated electronic care records system is a central programme for IT in the NHS, which was set up in 2002 and faced repeated criticism since then over its cost and technical problems. The chief executive of the programme has been criticised for failing to oversee the project properly. The main criticism of the programme was that it was designed from the top down, and that, the same system was being deployed nationwide without any consultation with the people who would be expected to operate the system, across a number of different regions, which had very different requirements and cultures. This is an approach which is almost guaranteed to result in failure. It has also been reported by (Ptak and Schragenheim, 2004), that between 60 and 90 per cent of ERP implementations do not achieve the return on investment identified in the project approval phase. Organisations and manufacturing enterprises have long seen the value in bringing computer technology to bear upon manufacturing, sales and distribution activities in an effort to improve overall productivity and profitability.

However, it is not all doom and gloom there have been significant success stories reported as well. Continental Airlines, having made a $30M investment in hardware, software, and personnel, were able to generate over $500M in revenue enhancements and cost savings, resulting in a ROI of over 1,000 per cent (Watson *et al*., 2006). This represents a very impressive performance indeed. Another organisation Lucent Corporation, were able to realise a US$ 250 million turnaround with six consecutive profitable quarters after implementing an IS to change the way the company did business (Watson *et al*., 2002). ERP systems are constituted from configurable IS packages that, integrate information and information-based processes within and across functional areas in an organisation. The current generation of ERP systems also provides reference models or process templates that claim to have the ability to embody best business practice solutions (Kumar and Van Hillegersberg, 2000).

2.11. Critical Success Factors

Key factors of success or failures during the ERP implementation phase have always been subject to intensive literature studies. It is therefore worthwhile to examine the factors that, to a great extent, determine whether the implementation will be successful. Numerous authors have identified a variety of factors that can be considered to be critical to the success of an ERP implementation. The most prominent of these are: strategic planning, gap analysis, reengineering, team training, testing, and post implementation. One of the first authors that applied the CSF approach in the IS area was (Rockart, 1979), and according to his account, CSF's are; *"the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation*". They have been applied to many aspects and tasks of IS, and more recently to ERP systems implementations. He proposed the

CSF method to help CEOs specify their own information needs about issues that were critical to their organisations, so that IS could be developed to meet those needs (Esteves and Pastor, 2001). The principal method used in CSF analysis is personal interviews, three or four, with a number of top managers identifying their goals and the resulting CSF's. These personal CSF's are aggregated to develop a picture of the firm's CSF's. Then systems are built to deliver information on these CSF's. For the method of developing CSF's in an organisation is illustrated in Figure 19.

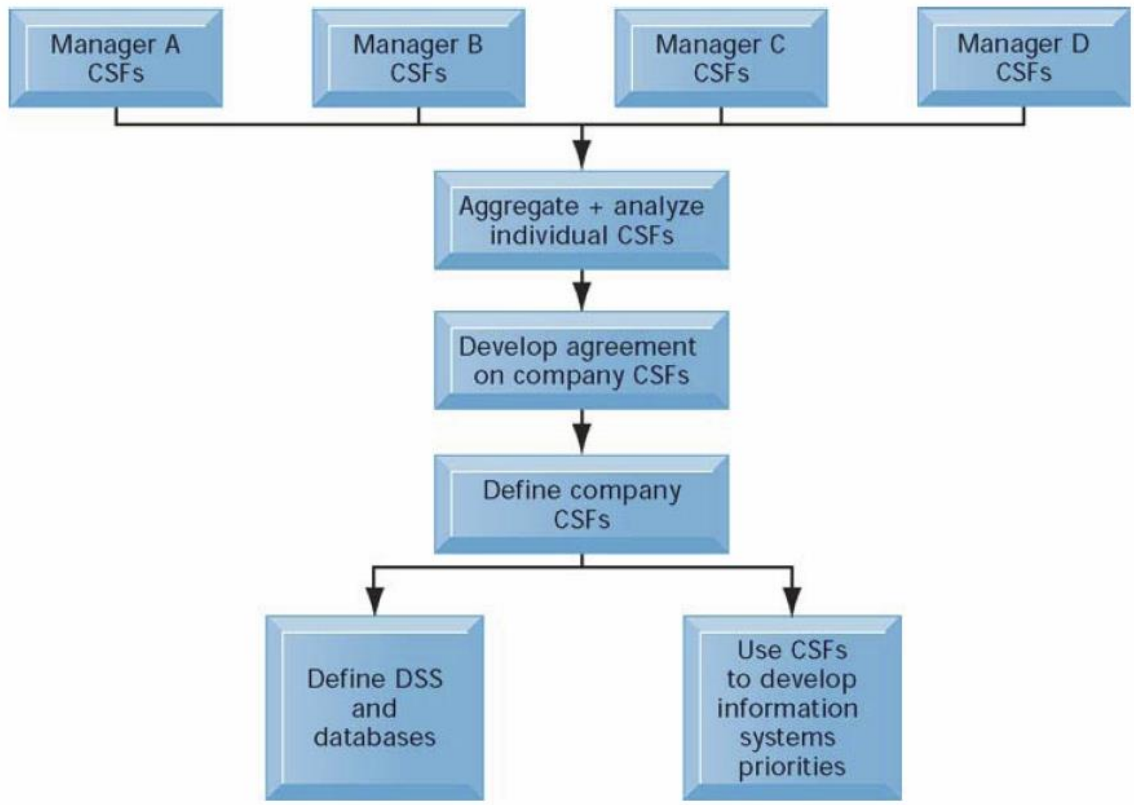


Figure 19: Using CSF's to Develop Systems. *Source: (Laudon et al., 2004)*

This method is clearly biased toward top managers, although it could be extended to gain new ideas for promising new systems from lower-level members of the organisation (Peffers *et al*., 2003). One of the strengths of the CSF's method is that it results in a smaller set of data to analyse than does enterprise analysis. Only top managers are interviewed, and the questions focus on a small number of CSF's rather than a broad inquiry into what information is used or needed. One of the primary weaknesses identified with the method is that the aggregation process and the analysis of the data are art forms. There is no particularly rigorous way in which individual CSF's can be aggregated into a clear company pattern. Second, there is often confusion among interviewees (and interviewer) between individual and organisational CSF's (Laudon *et al*., 2004). Based on a set of studies published by several authors, containing commented lists of CSF's in ERP implementations, (Pastor and Salgado, 2000), unified these lists and created a CSF's unified model, as illustrated in Figure 20.

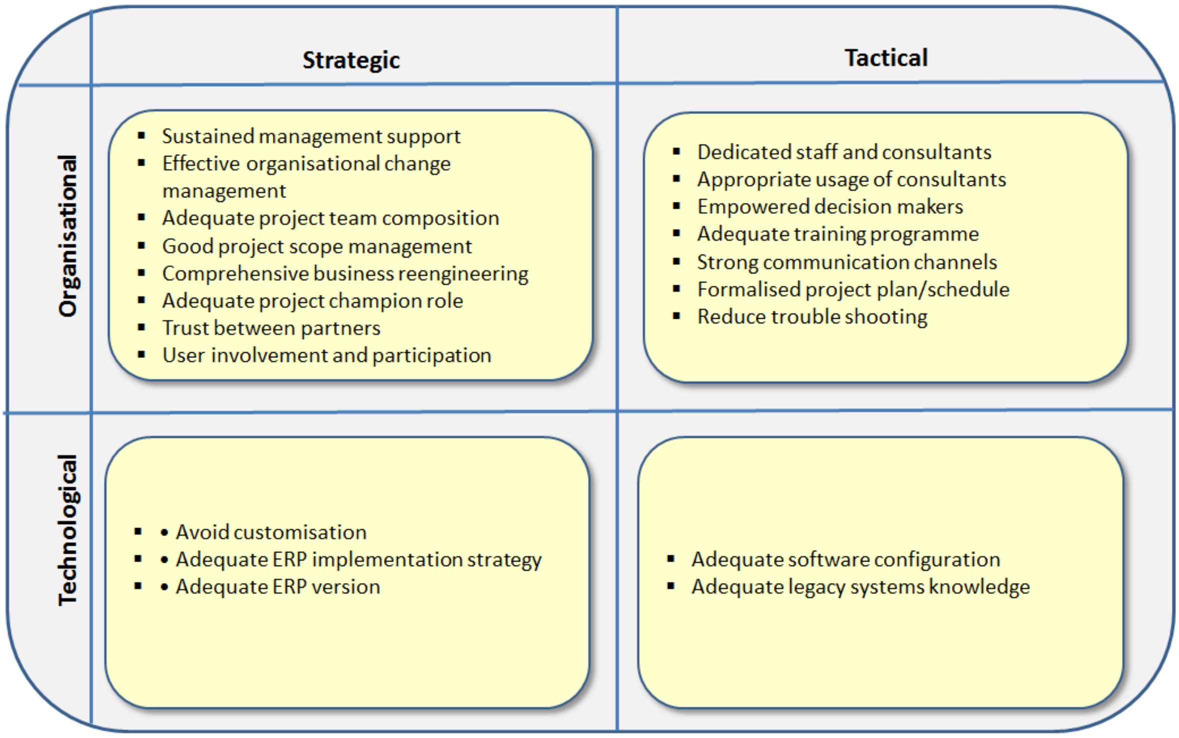


Figure 20: Unified Success Factor model. *Source: (Esteves and Pastor, 2001)*

(Bancroft, 1996), provided CSF's for ERP implementation, including top management support, the presence of a champion, good communication with stakeholders and effective project management. The factors specific to ERP implementation include reengineering business processes, understanding corporate cultural change and using business analysts on the project team. In another study, (Holland and Light, 1999a), developed a CSF's framework to help managers successfully plan and implement an ERP project. Their CSF's model includes strategic factors, such as the overall implementation strategy, and tactical factors such as technical software configuration and project management variables. The approach has been illustrated in case studies where analysis highlighted the critical impact of legacy systems upon the implementation process and the importance of selecting an appropriate ERP strategy. Research on the critical factors for initial and on-going ERP implementation success has been discussed by (Nah *et al*., 2001). In their paper, 11 factors were identified to be critical to ERP implementation success:

- ERP teamwork and composition.
- Change management programme and culture.
- Top management support.
- Business plan and vision.
- BPR with minimum customisation.
- Project management.
- Monitoring and evaluation of performance.
- Effective communication.
- Software development, testing and troubleshooting.
- Programme champion.
- Appropriate business and IT legacy systems.

In their study of the complexity of multi-site ERP implementation, (Markus *et al*., 2000), claimed that implementing ERP systems can be quite straightforward when organisations are simply structured and operate in one or a few locations, but when organisations are structurally complex and geographically dispersed, implementing ERP systems can involve difficult, possibly unique, technical and managerial choices and challenges. Through the use of a detailed survey and interviews with key players within a number of Belgian companies (Doom *et al*., 2010), was able to verify whether the ERP success factors discovered in the literature was relevant for those particular organisations. The questionnaire that he used during these interviews is included in appendix Four. The success factors of ERP implementation in China has been analysed by (Zhang *et al*., 2003), where the implementation success rate is significantly lower than in western countries (10 per cent instead of 33 per cent according to the authors). This statement can be related to the IEMC 2002 Report by (Ghosh, 2002), in which it is argued that most of the ERP software being developed is in technically advanced countries, where standards are often too high for under developed or developing countries. In an effort to bring the global organisation to a common platform, different countries would need different levels of upgrades.

2.12. ERP Published Literature

The body of academic knowledge with regard to ERP systems has reached a certain maturity and several different research disciplines have contributed to the field from different points of view using different methods, showing that the ERP research field is very much an interdisciplinary field. It demonstrates that the number of ERP publications has decreased, and it indicates that the academic interest in ERP is driven by an interest in an empirical phenomenon rather than that ERP is a new research discipline (Schlichter and Kraemmergaard, 2010).

The study carried out by (Schlichter and Kraemmergaard, 2010), reveals that more than 250 journals have published papers about ERP, and that the 20 most publishing journals have published approximately 30 per cent of the publications. The operation management discipline has published the largest amount of the papers, 31 per cent, followed by the IS discipline yielding 24 per cent of the publications, but no discipline has predominance. Studies on the implementation of ERP have been the most researched topic, accounting for 29 per cent of the papers, followed by studies on the management (18 per cent) and optimisation of ERP (17 per cent). Case studies have been the most used method, used in 22 per cent of the papers, but in the later part of the decade the use of this method is declining on the expense of, e.g. surveys. The total number of peer-reviewed journal publications was found to be 885. The number of papers published per year was rather steady until 2003, see Figure 21, when 116 papers were published, the highest number of papers published in one year.

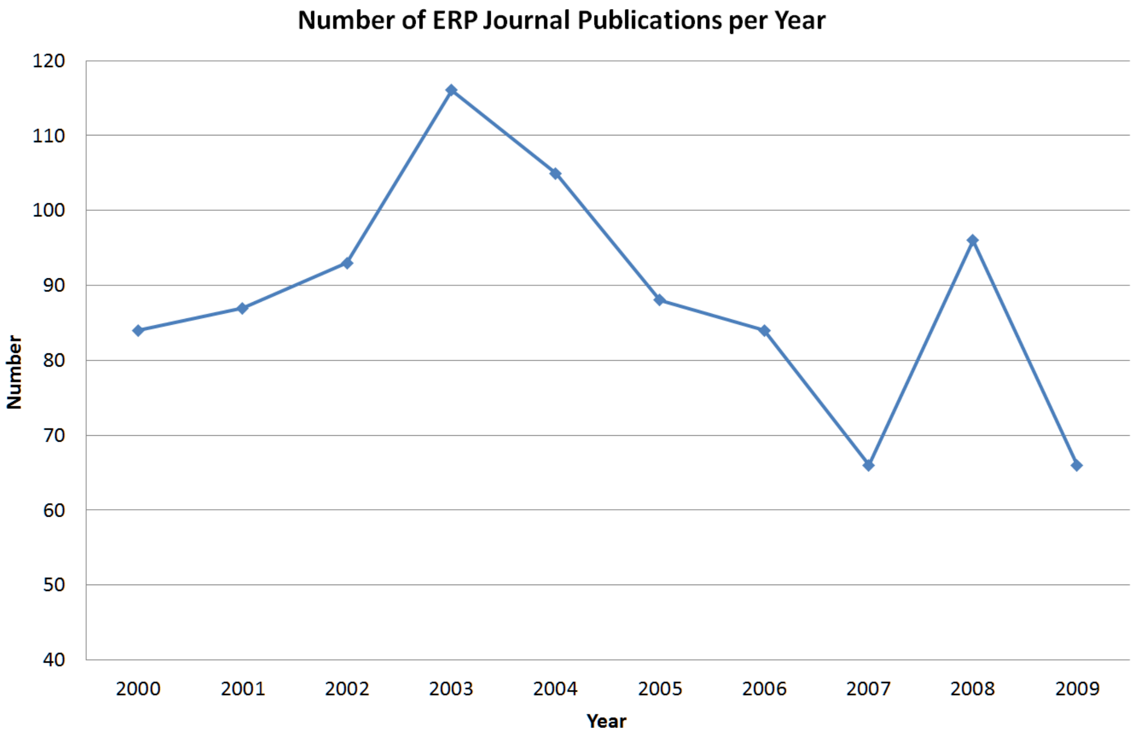


Figure 21: Number of ERP Journal Papers per year. *Source: (Schlichter and Kraemmergaard, 2010)*

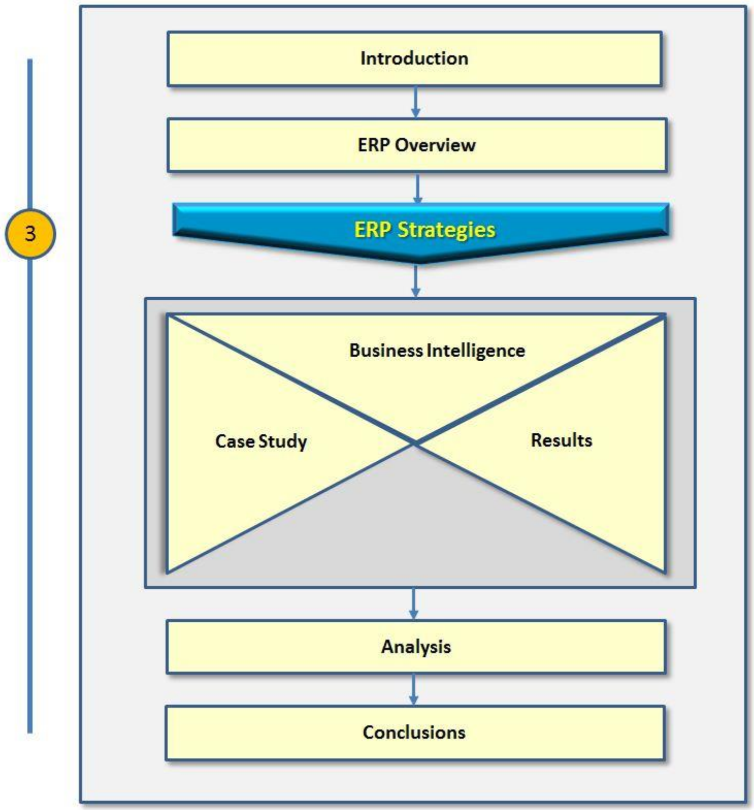
After 2003 the number of publications in 2004 was 105, and the number of papers published in 2005 and 2006 reached a similar level as at the beginning of the century. In 2007 the number of publications dropped to 66, the lowest in the period, followed by an increase in 2008 with 96 papers published, finally to reach a yearly publication rate of 66 in 2009. The high increase in 2008 can be explained from the data by the introduction of new journals with a special interest in ERP systems, e.g. the International Journal of Enterprise Systems in 2005, and a rather large amount of papers about ERP in developing countries by the end of the period. It was found that 226 journals published ERP papers between 2000 and 2009. The most contributing author to the field was S.C. Lenny Koh with 12 publications. Out of the total number the papers published during the period, 31 per cent were published in operations management, being the most contributing discipline, equalling 309 papers. The second most contributing discipline is information systems, which has contributed 233 of the publications, 24 per cent of the pool. Computer science contributed with 15 per cent followed closely by organisation and management with 13 per cent of the publications. Accounting accounts for the smallest number of publications, namely 9 per cent. The discipline contributing the most to the ERP research field is operations management, accounting for 31 per cent of the publications. The number of published papers reached its highest in 2003 with 116 papers. After 2003 the number reduced year by year to 66 papers in 2009, indicating that the interest in the subject area has declined.

Schlichter suggests that the interest in ERP was the result of a temporary widespread interest in an empirical phenomenon, rather than the beginning of a new research discipline. Although there may be an element of truth in that, the author would not entirely agree with it. There is a large body of research that exists which offers new insights, alternative viewpoints, and interesting research questions within the subject area, with (Grabski et al., 2011), noting that; The diversity of research on ERP systems reflects a number of different levels of analysis, offering interesting new perspectives with the potential to uncover insights into the complexities of the ERP systems artefact and the ERP organisational context. The overall scope of ERP-related literature is quite broad. As this area moves forward, ERP research needs greater focus on theoretical support and theory development to explain findings, exploration of new levels of analysis e.g., project, group, or sub-unit, and longer-term investigations into the mature stages of post-implementation use, upgrades, and the co-evolution of ERP systems, organisational structures, business processes, and individual job definitions (Grabski et al., 2011).

Chapter Three

ERP Strategies

"I think there is a world market for maybe five computers." - Thomas Watson, chairman of IBM, 1943.



This chapter will commence by looking at that the strategic decisions which need to be made at the executive and senior management level within an organisation with regard to the implementation of ERP. These decisions have a strong bearing on the outcome of the programme with respect to its success, or failure. The strategic perspective incorporates the following elements; the strategy with regard to the adoption of ERP, and the extent and scope of the deployment within the organisation. To this end it is absolutely critical that the CEO and the executive level management within the organisation establish a clear vision of how the ERP implementation fits in with the overall strategic alignment of the organisation. The putting in place of a strong project team to drive the ERP programme forms a core element of the strategy. Management must also recognise the impact that the ERP implementation will have upon the organisational structures within the organisation, and the steps which are required in order to mitigate possible negative aspects, and provide for a smooth transition to the new operating system.

The strategies that can be employed with regard to the adoption and implementation of ERP will be both governed and constrained by the organisation's ability and willingness for change, combined with its ability to absorb the level of change required. Decisions based around these factors, will determine the scope of the implementation, and whether the deployment is going to be of a limited nature, over a relatively short period of time, or it will be of an all-encompassing nature, over a longer time frame. The point has been made by (Slevin and Pinto, 1987), that both strategy and tactics are essential for successful project implementation, and that their importance shifts as the project moves through its life cycle. Strategic issues are most important at the beginning, whereas tactical issues gain in importance toward the end. There should be continuous interaction and testing between the two, strategies change in dynamic organisations, so regular monitoring is essential. This requires that a successful project manager must be able to make the transition between strategic and tactical considerations as the project progresses. It is within the planning phase that the decisions are made in relation to the commencement of the ERP project, the methodologies to be employed and the completion dates, the design of the implementation process emerges, and the details of the methodology to be employed are decided. The timelines, schedules, and deadlines for the project are arrived at, the plan is developed, roles are identified and responsibilities are assigned. It is in this phase that a team will be formed, consisting of team members from within the key functional areas of the organisation, who will have responsibility for the planning stage. ERP implementation teams should be composed of key personnel who are chosen for their, past accomplishments, reputation, and flexibility. These people should be entrusted with critical decision making responsibility. Team members should be selected from sales, customer service, accounting, purchasing, operations and senior management. It is important to include front line workers, as well as management on the team. The selection of key personnel should be based on the strength of the knowledge of each team member, and not on the status of the employee. Each team member should be committed to the success of the project and be accountable for specific tasks, i.e. developing a timeline, finalising objectives, and formulating a training plan. Management should constantly communicate with the team, but should also enable empowered, rapid decision making (Sherrard, 1998). The implementation team is important because it is responsible for creating the initial, detailed project plan or overall schedule for the entire project, assigning responsibilities for various activities and determining due dates. The team also makes sure that all necessary resources will be available as needed.

3.1. Adoption

Planning for ERP adoption generally occurs when an organisation realises that the current business processes and procedures no longer provide for their current strategic needs. The first step in planning, therefore, is an internal needs assessment. Since the total ERP implementation costs including software, hardware, consulting, and internal personnel can easily run as high as 2 per cent or 3 per cent of a company's revenues, the needs assessment can help determine whether a company should maintain and enhance a legacy system or implement a new ERP system. Convincing reasons for a new ERP system may include:

- ❖ The inability of the existing system to support organisational needs.
- ❖ The use of multiple points of input with duplicated effort in the existing system.
- ❖ The requirement of extensive resources for maintenance and support.
- ❖ The consideration of an enterprise to reengineer its business process.
- ❖ The growth of the enterprise and subsequent incompatibility of several IS's
- ❖ The inability of employees to respond easily to questions or information requested by key customers or suppliers.

The strategy of ERP adoption is a key factor of performance, and (Bendoly and Kaefer, 2004), use a transaction cost economics model in which they assert that transaction efficiency is magnified when ERP implementation precedes a B2B initiative. (de Vaujany, 2003) identifies *"appropriative trajectories"* of organisational change facing computer and software growth, linked to specific *"logics of control."* ERP use, has a great impact on the transformation of an organisation (Holland and Light, 1999b), and especially on control, permitting a centralised view by senior management of each entity, or allowing the controlling of a matrix structure through real-time information (Quattrone and Hopper, 2005). Studies confirm that the introduction of new business and organisational practices, are highly correlated with labour productivity (Falk, 2005). The contribution that ERP makes to enterprise performance is now well recognised. ERP is also a driver for more efficient utilisation of both the internal and external supply chain (Bergstrom and Stehn, 2005). Fitting ERP to business best practices has also been investigated from a management point of view (Gardiner *et al*., 2002), which has resulted in a streamlined sales order process, with managerial implications to pursue the reduction of marketing cycle times and enhance customer service relationships between the ERP system, and the underlying data models of the best known theoretical accounting enterprise database model called *"resources events agents"* (O'Leary, 2002). However, some studies have revealed that ERP has led to relatively small changes in management accounting and control procedures. This seems to be linked with the extent of integration, as in most cases, advanced management accounting techniques, and many of the traditional ones, are operated in separate systems (Granlund and Malmi, 2002). Researchers have studied the impact of ERP on IS design and development, prior to researching the impact of ERP on business and implementation programmes. Until 2002, less than 25 per cent of research ERP articles focused on IT aspects. After 2003, this aspect of ERP became more prominent with 40 per cent of articles focusing on ERP and architecture, design, data model, Web services, and enterprise application integration.

Technical aspects of ERP have focused on integration, which relates to the; processes, applications, networked enterprise, and the supply chain, and which involves additional functions, including decision making, stakeholders relationships, and transportation. This extension of the ERP concept and its consequence on IS architecture has been defined as extended ERP or ERPII. This has led (Gillmann *et al*., 2010), to describe alternative IS architectures, in which flexible and customised federations of smaller business components interact, even over enterprise and intranet boundaries, by means of a platform-neutral communication bus. Recent studies have also addressed the concept of IS architecture. A company is no longer directly mapped to a single database of a unique ERP server, but needs to be modelled inside a corporate or supply chain level. The IS has to support distributed systems (Verwijmeren, 2004), where requirements for planning and operations in networked organisations and supply chains are solved using Web server integration (Kovács and Paganelli, 2003). Integration to the execution level by way of Manufacturing Execution System (MES) using mobile software agents is proposed by (Klostermeyer and Klemm, 2003). In order to match the ERP system with an organisation's business processes, companies have to customise both the system and, or the organisation. To avoid high maintenance costs or to deploy a standard corporate model in an international group, some corporations are implementing ERP systems without, or with minimal customisation (Ghosh *et al*., 2002). Nevertheless, although efficient, these systems do not supply the level of flexibility required to support existing and emerging customer trends. Technical and process change capabilities for customisations are identified, in order to propose a framework for supporting management decision-making about customisation choices (Luo and Strong, 2004). Combinations of other IT technologies with ERP systems are nowadays also considered, as in (Newell *et al*., 2003), where knowledge management and ERP implementation programmes are shown as being complementary. In a case study, (Ng and Ip, 2003), suggest an implementation model for Internet-enabled ERP systems. An important role of ERP is to serve as a platform for other applications, such as CRM and SCM, and in spite of the latest developments of ERP software that provide a unified platform for managing and integrating core business processes within a firm, including, the decision-making process between marketing and production planning on the whole supply chain, this role still remains a rather challenging one, and it remains an active area for further research.

For many organisations, a key question that arises is not whether an ERP system is needed but rather, what kind of system is needed? Thus, once the company decides to implement a new ERP system, the next step is defining a *"TO-BE"* status, and envisioning the alternate structures at the end of the ERP project. Developing a vision of the *"TO-BE"* status after implementation, clarifies the goals of the project. This helps to determine the appropriate modules and functions to be included in the system, which in turn facilitates identification of all the benefits that can be gained and therefore, provides an effective strategy for winning over project support. More importantly, it is the yardstick of performance against which implementation progress is measured (Chen, 2001). The primary motive for ERP installation is the potential for enhancing the competitiveness of the firm. Since different organisations have varying competitive objectives, their expectations of ERP can vary quite considerably. Top management, therefore, must examine the firm's current competitive position in relation to its desired position before deciding on a particular ERP system or various modules to be incorporated within the system. Competitive strategy, targeted market segments, customer requirements, manufacturing environment, characteristics of the manufacturing process, supply chain strategy, and available resources all enter into the decision. Compaq Computer is a good example of a company that realised the importance of manufacturing environment and competitive strategy. In 2001, Compaq merged with Hewlett-Packard. Informed by the very obvious success of other build-to-order personal computer companies such as Dell and Gateway, Compaq decided to shift from build-to-stock to build-to-order. It understood however, that superior capabilities in demand forecasting and order management are key factors that are required for a competitive advantage in the build-to-order environment. Compaq therefore, decided to write its own proprietary applications to support the forecasting and order processing processes. They were astute enough of understand the importance of their own system being able *"to talk"* to their vendor supplied ERP system, and they therefore, ensured that their in-house application was written in the same language, and used the same protocols as the ERP system. As discussed in the previous chapter, the peculiar feature characteristics of ERP as a complex organisational initiative, brings about the question of whether or not a competitive advantage can be gained from a standardised software package when a firm's competitors also have the opportunity to implement the same or a similar package. As the Fortune 1000 ERP market begins to saturate, more and more vendors begin to target hundreds and thousands of midsize and small companies. The real competitive advantage brought by the ERP systems for these companies appears to hinge on who can achieve a tighter, smoother fit between its business process and the ERP system. Companies often fail to consider whether the system they are evaluating will match their overall business strategy (Davenport, 1998c, Davenport, 1998b). It is therefore prudent that the characteristics of an ERP software system match the criteria used by an organisation to select an IS. The results of a survey of the criteria used by organisations, in selecting their current IS, shows that the best fit with current business procedures is the most important one (Van Everdingen *et al*., 2000). Clarkston Potomac (Computer Technology Research Corporation, 1999) suggests several practices to ensure a successful ERP selection process, including:

- Staying on schedule.
- Including human resources representatives in the assessment of IT capabilities.
- Not allowing vendors to drive the presentations of demonstrations.
- Entering product presentations or demonstrations with a clear agenda and communicate that agenda to the providers.
- Ensuring that test scenarios represent a variety of departments.
- Building test scenarios that represent current and future processes.
- Documenting assumptions about what the ERP system will accomplish.
- Recording all conclusions reached about each vendor and system.

- Respecting dissenting options.
- Scheduling breaks between product reviews.
- Resisting the temptation to rank candidates.
- Eliminating clear losers immediately.
- Using experienced negotiators, and maintaining site of original plans.

Along with the above (Rao, 2000), is of the opinion, that with regard to small and medium enterprises, they should check for five important criteria when selecting an ERP package. These are affordability, domain knowledge of suppliers, the level of local support, software upgradability and use of latest technology.

3.2. Scope

The commercially available software packages promise seamless integration of all information flows in the company; financial and accounting information, human resource information, supply chain information, and customer information. For those managers who have struggled, at great expense and with great frustration, with incompatible Information Systems and inconsistent operating practices, the possibility of being able to acquire *an "off-the-shelf"* solution to the problem of business integration is a very appealing one (Umble *et al*., 2003). Table 4 illustrates the scope of an enterprise system.

Financials	**Operations and Logistics**
Accounts receivable and payable Asset Accounting Cash management and forecasting Cost element and cost-centre accounting Executive Information Systems Financial consolidation General Ledger Product-cost accounting Standard and period related costing	Inventory Management Materials Management Plant maintenance Production planning Project Management Purchasing Quality Management Routing Management Shipping Vendor evaluation
Human Resources	**Sales and Marketing**
Human-resource time accounting Payroll Personal planning Travel expenses	Order Management Pricing Sales Management Sales planning

Table 4: Scope of Enterprise System. *Source: (Umble et al., 2003)*

Implementing an ERP system is not an inexpensive or risk-free venture. In fact, 65 per cent of executives believe that ERP systems have at least a moderate chance of having a negative impact on their businesses, because of the potential for implementation problems (Cliffe, 1999). ERP systems are complex, and implementing one can be a difficult, time-consuming and expensive project for any organisation. For instance, the ERP adoption time, typically, takes from a few months for firms accepting all default settings, to years for firms needing to make major modifications. It costs tens of millions of dollars for a medium sized company and $300-500 million for large international corporations (Mabert *et al*., 2001). Along with obvious costs of an ERP implementation, there are also some possible hidden costs that may include; losing key employees after the initial implementation is completed, continual implementation and training, waiting for Return on Investment (ROI) and post-ERP depression (Coffey *et al*., 2001). Moreover, even with significant investments in time and money, there is no guarantee of the outcome (Mabert *et al*., 2001). Although most ERP systems already have business practice processes already established, not all of them are necessarily best in class applications for a specific firm. The firm still needs to select those applications available from software vendors for its specific requirements, and integrate both applications and ERP system into the firm's IT backbone (Shehab *et al*., 2004).

Because ERP has made it easy to integrate other competing best in class applications, most firms, either face the high cost of modifying the ERP modules to meet their requirements or simply do not install the applications. Indicative of the problems that can arise, it has been reported that some retailers face difficulties, when they implement ERP applications that were developed with manufacturers in mind (Chung and Snyder, 2000). One of the aims of implementing ERP systems is to uphold the highest quality standards of the business process. However, when the business conditions have changed, the system may not guarantee that the process embedded in ERP is still the best. Hence, for example, a multi-agent system for adaptive inventory control in, an ERP system has been proposed by (Kwon and Lee, 2001). A model to identify, analyse and present the problems of ERP systems has been proposed by (Themistocleous *et al*., 2001), in order to examine new approaches to Application Integration (AI). They claim that ERP systems amplify the need for integration, as existing systems have to be incorporated with ERP applications. AI securely incorporates functionality from disparate applications and leads to the development of new strategic business solutions for enterprises. The results of the research confirm AI as a new means of system integration that adds value by placing business logic in the applications network, thus creating a more dynamic IS infrastructure. Additionally, organisations face many problems when customising ERP packages. Thus, customisation problems do not allow companies to make serious changes to the ERP package. IT and business managers also argue that ERP suites tend only to have one best in class application. For instance, PeopleSoft is linked with a good human resources module and Oracle with financials. Furthermore, organisations may be left waiting for the next upgrade from their ERP software vendor when they require further functionality.

3.3. Strategic Alignment

The alignment of the standard ERP processes with the company's business processes has been, for a long time considered to be a critical step of the implementation process, and thus holds the attention of many researchers. Process mining, which was introduced as a preliminary step of ERP implementation by (van der Aalst and Weijters, 2004), while (Chiplunkar *et al*., 2003), suggest the capture of the complete business environment in a BPR project with the help of IT, while (Daneva, 2004), considers that reusing business processes and data requirements is a major issue of implementation, and (Soffer *et al*., 2003), suggest a reverse engineering process for obtaining an ERP model, which can be aligned with the needs of the enterprise. The problem of process alignment is defined by (Daneva, 2003), in terms of composition and reconciliation: a general set of business processes and data requirements is established, then standard ERP functionalities are explored to see how closely they match the organisation's process and data needs, and (Luo and Strong, 2004), see the alignment in terms of customisation of the standard ERP processes, while an elicitation-based method is suggested by (Kato *et al*., 2003), for comparing user requirements to existing packages.

According to (Ho *et al*., 2004), system implementation is a challenging management issue, and is no less important than system research and development. They further emphasise that owing to the rapidly changing business environment, ERP implementation is seldom a simple matter of realising a plan; instead, it is often a dynamic process of mutual adaptation between IT and the surrounding environment. Given the slim possibility of achieving a perfect match between technology and organisation, misalignment can occur which can be rectified through technological measures, organisational measures or, a combination of both. A case study was conducted by (Ho *et al*., 2004), in order to examine three dimensions of alignment between the organisation and ERP systems, by employing a technology adaptation perspective and case research methodology. They adopt the Leonard-Barton model as a research framework, in which (Leonard-Barton, 1998), argue that a firm's core capabilities arise out of its knowledge-creating activities. This framework addresses critical issues according to the dimension into which they fall. There are three dimensions in this framework; technology, delivery system and, performance criteria. The technology dimension issues are; adequacy for specification, user's maturity for the application of new technology, and evaluation and integration for legacy system. In relation to the delivery system, critical issues relate to: role of the Management Information System (MIS) department in the organisation, process adaptation, harmonious implementation, system establishment, project management, employee education and training, external partner support and internal staff involvement. The issue of performance criteria can be performed through evaluation. (Ho *et al.*, 2004), advise that during implementation, all three dimensions influence each other. A successful implementation will benefit from the application of all three dimensions, and not a single one. To this effect, and based on the results of their case study surveys, they develop an adaptation framework for ERP implementations, as shown in Figure 22.

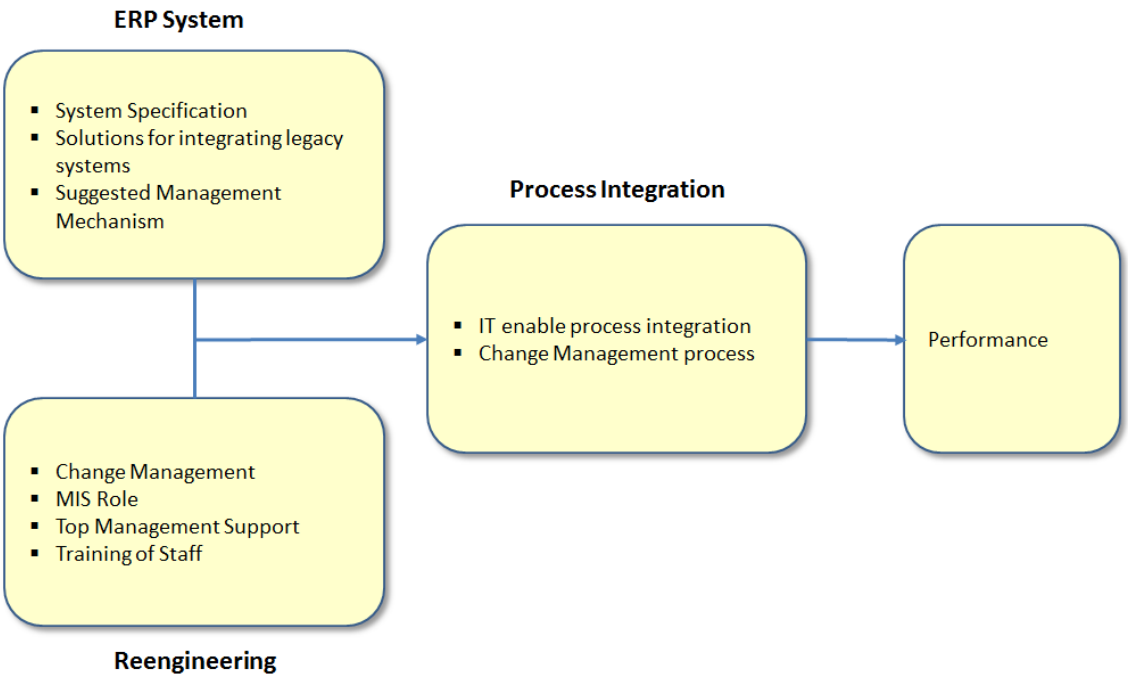


Figure 22: Adoption Framework for ERP Implementation. *Source:(Ho et al., 2004)*

Business processes enable enterprise productivity, and technologies and systems enable business processes. However, aligning business processes with technologies and systems is often a challenge. Executives define organisational priorities and objectives, and managers are responsible for ensuring that the business processes are executed to meet priorities and objectives. Alignment involves ensuring the systems and technologies are properly aligned with the business processes. Understanding and documenting end-to-end business-process scenarios is consistent with a three-tiered solution framework, as shown in Figure 23, the alignment, is not automatic, and misalignment is the source of many organisational problems.

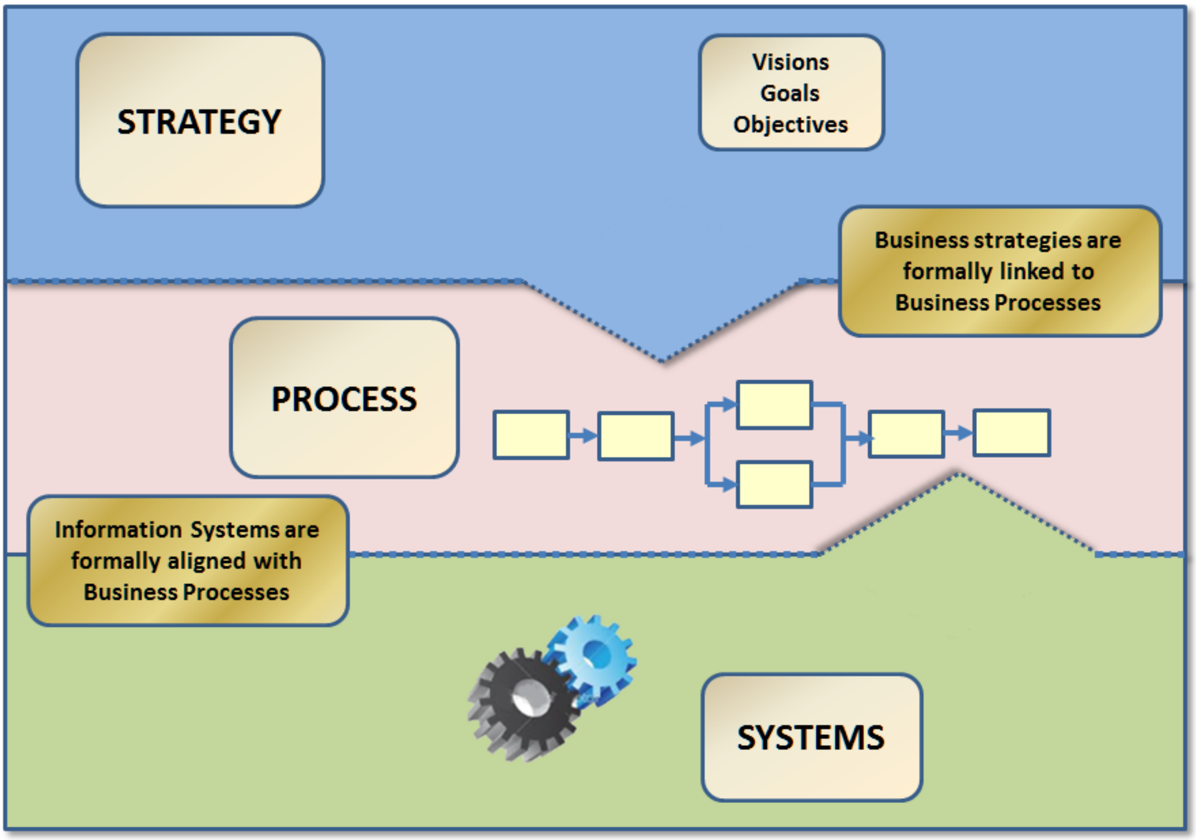


Figure 23: End to End business Process Scenarios. *Source:(Frye and Gulledge, 2007)*

A properly designed enterprise integration framework must include alignment across all three levels. Enterprise integration is the alignment of strategies, business processes, IS, technologies, and data across organisational boundaries to provide competitive advantage. The process of achieving enterprise integration includes all managerial and technological factors that enable cross-functional process integration. The result is a customer-oriented management structure with IS formally linked to processes and the integration of processes needed to establish and retain customer satisfaction. This definition of enterprise integration also means that business processes flow across organisational boundaries, which adds significant complexity to business-process management. Managers manage business processes implicitly or explicitly. Even if no explicit documentation and management approaches are in place, work is still accomplished, so the processes are managed implicitly; even if that means responsibility shifts from one manager to another with no attempt to coordinate. Explicit management and improvement is desirable however, so the discipline of business-process improvement is core to the management disciplines.

3.4. Project Management

Effective project management is critical to the success of ERP implementation. Not only should responsibility for the project be clearly assigned (Rosario, 2000), the scope of the ERP implementation project also needs to be clearly defined and controlled (Bajwa *et al*., 2004). An individual or group of people should be given responsibility to drive success in project management (Holland and Light, 1999a). First, scope should be established and controlled. The scope must be clearly defined and be limited to the ERP project itself and not include any other projects. This includes the amount of systems implemented, involvement of business units, and amount of BPR needed. Any proposed changes should be evaluated against business benefits and, as far as possible, implemented at a later phase. Additionally, scope expansion requests need to be assessed in terms of the additional time and cost of proposed changes (Markus *et al*., 2001). Then the project must be formally defined in terms of its objectives. The critical paths of the project should be determined. The timeliness of the overall project and the taking of timely decisions should be dealt with competently. Deadlines should be met to help stay within the schedule and budget (Markus *et al*., 2001). Project management should be charged with coordinated training and active human resource department involvement. Additionally, there should be planning of well-defined tasks and accurate estimation of required effort (Markus *et al*., 2001).

One of the most often cited drivers of success in implementing an ERP is finding the key people to fill the key ERP leadership roles. In particular, the project manager role is among the most critical. Managing an ERP project is a daunting undertaking. Strong project management skills are a must. During the life of the project hundreds of tasks must be staffed, scheduled, and controlled. The project manager will build and execute a communication plan, carry out a risk analysis, maintain issues logs, produce reports and conduct efficient meetings. A good project manager is organised, disciplined, and uses schedule and budget metrics. It has been argued that, the selection of the project manager is *"without question one of the most important decisions in relation to the entire ERP project"*. In addition, professional project management is critical on an ERP project, even if it is necessary to hire a third party from outside, to bring the ERP management skills and experience to the project (Edwin, 2006). In order for an ERP implementation project to be a success, timeliness must be enforced and progress must he tracked by monitoring milestones and targets (Al-Mashari *et al*., 2003). Any changes in the original project should be evaluated based on their business benefits and, if possible, implemented at a later time. Furthermore, changes to the scope of the project must be assessed based on the additional time and cost it would entail (Sumner, 1999). Due to the large number of parties involved in an ERP implementation, it is critical to coordinate project activities across all affected parties (Falkowski *et al*., 1998). Internal integration tools are essential to coordinate activities involving the project team while external integration tools are necessary to facilitate collaboration with external stakeholders and to assure that user and process requirements are being integrated into the system (Bajwa *et al*., 2004). The success of the project can be gauged by completion dates, costs, quality, and system performance.

Approximately 90 per cent of ERP implementations are late or over budget according to (Martin, 1998), which may be due to poor cost and schedule estimations or changes in project scope, rather than project management failure, and (Holland and Light, 1999b, Slevin and Pinto, 1987), argue that in order to manage a project successfully, project managers must be capable, both in strategic and tactical project management activities. They propose ten project management critical success factors that fall in either the strategic or tactical phases of a project. The strategic factors are: project mission, top management support and project schedule/plan; while tactical factors are: client consultation, personnel recruitment, technical task, client acceptance, monitoring and feedback, communication, and troubleshooting (Slevin and Pinto, 1987). With new technology, it is often critical to acquire external expertise, including vendor support, to facilitate successful implementation (Sumner, 1999). Hundreds of companies provide ERP services, which may include all or some combination of ERP selection, business process planning or reengineering, ERP implementation, end-user training and ERP maintenance and support. With the rapid growth of the ERP market, there has been a lack of competent consultants. One of the challenges with ERP implementation is that, it demands multiple skills covering functional, technical, and inter-personal areas. If these skills are found in a consulting firm, it is another challenge for an organisation to manage such a consultant (Bingi *et al*., 1999). However, an important success factor here is for the organisation to establish a knowledge transfer mechanism, by which the consultant's role is defined clearly and their skills and expertise are acquired and transferred adequately.

3.5. Process Management

To take full advantage of an ERP software, business process redesign is a prerequisite (Holland and Light, 1999a). Because ERP systems are essentially developed as instruments for improving business processes such as manufacturing, purchasing, or distribution, ERP implementation and BPR activities should be closely connected (Al-Mashari and Zairi, 1999). This is achieved through an exhaustive analysis of current business processes to identify the potential chances of reengineering, rather than designing an application system that makes only the best of bad processes. It is reported by (Scheer and Habermann, 2000, McAdam and Galloway, 2005), that key organisational issues are teamwork, change management, top management support, plan and vision, business process management and development, project management, monitoring and review, effective communication, software development and testing, the role of the project champion and appropriate business and IT legacy systems. The results of their study indicate that the complex organisational change issues must be comprehensively addressed. These issues cannot be resolved solely with technical solutions. To support these results, (Huang *et al*., 2003, Huang *et al*., 2004a), suggest that in addition to developing the technical aspects of ERP, more effort is required in understanding the more complex organisational issues involved. A case-based research approach was used by (McAdam and Galloway, 2005), to explore the organisational issues involved in implementing an ERP system within a large global organisation where SAP R/3 was implemented. They report that roles and responsibilities are key implementation issues based on their interview data. Although some managers perceived they faced a challenge due to process change and enriched roles, there were also concerns that the ERP package removes duplicity, replaces or removes manual and decentralised common tasks and results in many back offices being consolidated into one, with employee redundancy implications. Therefore, some roles could potentially disappear. Clearer communication of the business drivers for the change and reassurance on this issue could have increased management commitment (Nah *et al*., 2001). Based on an extensive literature review on the subject of commitment, (Meyer and Allen, 1991), defined three forms of commitment:

- ❖ Affective commitment refers to the employee’s attachment to, identification with, and involvement in the organisation.
- ❖ Normative commitment reflects a feeling of obligation to continue membership with the organisation.

- Continuance commitment refers to an awareness of the costs associated with leaving or abandoning the organisation.

Affective commitment is related to the extent of involvement of top management in ERP project activities, as they demonstrate their identification with the project through the participation in the different project events showing that they share the project values. Top management commitment, when percolated down through the organisational levels results in an *"overall"* organisational commitment. An overall organisational commitment that is very visible, well defined, and felt is a sure way to ensure a successful implementation (Bingi *et al*., 1999)**.** Top commitment must not be limited to the conception of the project, but should continue through to its completion phase. (Chen, 2001).Their commitment implies that they are willing to spend significant amounts of time serving on the steering or executive committee, overseeing other aspects of the programme. Normative commitment is related with the obligation to remain within the project. One of the CSF's in ERP implementation projects is the dedication of staff to the ERP project, since as a rule staff are not allocated for 100 per cent of the project duration, they usually keep doing their normal activities in parallel. Continuance commitment is related with the costs associated with personnel who leave or abandon the project and the organisation prior to project completion. This is an important point in ERP projects as a critical issue relating to project success relates to the turnover of key personnel.

Another common outcome from the interview data were that ability, experience and communication capabilities were all prerequisites for good ERP implementations and adopting changed processes (Huang, 2002, Van Stijn and Wensley, 2001). Where any manager had evidence that their staff had these qualities in relation to ERP, then the change became more effective. Many of the problems associated with the SAP R/3 delivery within a number of organisations, highlighted a lack of these prerequisites as a common denominator among many managers. The interview data also showed that there were no guarantees that being more mature in years or with more managerial experience made managers better at adapting to innovation or process changes. The ability to effectively manage ERP change was found to be either as a consequence of previous training or the preferred style or behaviour of individual managers (Huang *et al*., 2003). There was evidence to suggest that training along with practical awareness of the change drivers regarding ERP implementation could help managers and staff to understand the issues and therefore, become more comfortable in working with the SAP R/3 driven changes. Many managers frequently went back to the most accomplished SAP or IT-literate members of their teams and tended to ignore the other staff, leading to delays and potential personnel problems. Limited training in SAP R/3 skills was a concern for most of the managers, as also found by Huang (Huang *et al*., 2003). However, there was a desire to know more about SAP and to learn how to use it more effectively. There is a need for a more systematic SAP training and development approach, which should include exposing managers to the practical examples of SAP and major business process changes implementation.

A survey was conducted by (Themistocleous *et al*., 2001), to identify, analyse and present the problems of ERP systems. The findings of their survey highlight two types of ERP implementation problems, managerial and technical, which demonstrate that project cost overruns and delays were significant problems and affected seriously, the implementation phase and the whole project (Themistocleous *et al*., 2001). Other kinds of problems encountered during implementation were conflicts with external entities such as consultants and ERP vendors, as well as internal conflicts. These conflicts were instrumental to project delays and cost overruns. Approximately 42 per cent of the surveyed companies faced severe problems with their business strategies (Themistocleous *et al*., 2001), as the ERP system imposed its own way of doing business (Davenport, 1998c). Additionally, the surveys indicated that ERP solutions caused organisational restructuring, and consequently led to employees' resistance to change (Momoh *et al*., 2010), which in turn, led to project delays experienced by 58 per cent of the surveyed companies. This supports the argument (Sumner, 1999), that there is a major resistance to change after an organisation rolls out ERP. The surveys further indicate that serious customisation problems encountered by 72 per cent of the companies surveyed were caused during implementation and post-implementation. Customisation also led to integration problems. Furthermore, according to 82 per cent of the companies that participated in the surveys, integration problems were experienced in an attempt to tie up the ERP systems with a number of existing applications, and (Ehie and Madsen, 2005) suggest, that unfortunately, many organisations equate successful ERP implementations with the choice of ERP software. While it is imperative that the choice of the software should be carefully considered, ERP software should not drive the business decision-making process. Implementing an ERP solution requires thorough strategic thinking that allows companies to gain a better understanding of their business processes. It is imperative for companies to be aware of critical issues affecting ERP implementation and give careful considerations to the issues which would lend themselves to streamlined rollouts and timely implementation of ERP systems (Momoh *et al*., 2010).

3.6. Organisational Structures

The existing organisational structures and processes found in most companies are not compatible with the structure, tools, and types of information provided by ERP systems. Even the most flexible ERP system imposes its own logic on a company's strategy, organisation, and culture. Thus, implementing an ERP system may force the reengineering of key business processes and the development of new business processes to support the organisation's goals (Minahan, 1998). Redesigned processes require corresponding realignment in organisational control to sustain the effectiveness of the reengineering efforts. This realignment typically impacts most functional areas and many social systems within the organisation. The resulting changes may significantly affect organisational structures, policies, processes, and employees. Unfortunately, many chief executives view ERP as simply a software system and the implementation of ERP as primarily a technological challenge. They do not understand that ERP may fundamentally change the way in which the organisation operates. This is one of the problematic issues facing current ERP systems. The ultimate goal should be to improve the business, not to implement the software. The implementation should be business driven and directed by business requirements and not the IT department (Chew *et al*., 1991, Minahan, 1998). Clearly, ERP implementations may trigger profound changes in corporate culture. If people are not properly prepared for the imminent changes, then denial, resistance, and chaos will be predictable consequences of the changes created by the implementation. However, if proper change management techniques are utilised, the company should be prepared to embrace the opportunities provided by the new ERP system, which will make available more information and make attainable more improvements, than at first seemed possible. The organisation must be flexible enough to take full advantage of these opportunities (Sherrard, 1998).

It is estimated that about half of enterprise system projects fail to achieve hoped-for benefits, because managers significantly underestimate the efforts required to manage effectively the wide range of changes involved (Pawlowski, 1999). ERP systems are designed in such a way, that they support a variety of logical organisational structures. Consequently, customising and configuring an ERP software system, involves creating a logical structure that in turn involves one or more financial entities and one or more operational entities (manufacturing and/or sales and distribution units) (Markus *et al*., 2000). This requires a large change in an organisation's structure and affects the way people work and interact. Therefore, it is important that an organisation goes through a carefully planned transformation that is based on adequate strategy and well-defined methodology of implementation (Bingi *et al*., 1999). The implementation phase of ERP systems is an area that has also been the subject of much research. Despite this fact, it still remains an area of active research. Two distinct research streams have emanated from within the literature, the first stream focuses on the fundamental corporate capabilities driving ERP as a strategic concept, the second stream focuses on the details associated with implementing IS and their relative success and cost. These two streams can be further divided as follows:

- Sociological and cultural factors influencing the implementation success.
- The implementation steps.
- The business process alignment phase.
- The factors of success and reasons for failure.

The cultural and sociologic dimensions, like shared beliefs that users form about the benefits of a technology can pose a specific challenge for the control of enterprise systems (Kumar *et al*., 2002b). It is now, a well-recognised fact that, human factors have a very strong impact within the ERP implementation phase. Pre-implementation involvement is a key issue for obtaining a positive attitude from the workforce towards any proposed implementation of an ERP system (Abdinnour-Helm *et al*., 2003). The impact of cultural aspects on the success of the implementation phase, have also been analysed in a number of academic papers. For example, (Jones *et al*., 2006) suggest, that the findings from a multi-site case study, demonstrate that similar cultural attributes can facilitate knowledge sharing during the ERP implementation phase. (Yen and Sheu, 2004), also claim that national culture can be a critical factor in multi-national settings. The point has also been made by (Lander *et al*., 2004) that, the building of trust-building mechanisms between team members and other actors of the project are key issues that need to be addressed during the implementation process. The impact of the company cultural issues is also considered as a key dimension of the implementation process, as discussed by (Yusuf *et al*., 2004). Conflicts during the implementation phase can also frequently occur and to this end, and (Luo and Strong, 2004), suggest a method for controlling the tensions, both during and after the project.

It is reported by (McAdam and Galloway, 2005), that key organisational issues are teamwork, change management, top management support, plan and vision, business process management and development, project management, monitoring and review, effective communication, software development and testing, the role of the project champion and appropriate business and IT legacy systems. The results of their study indicate that the complex organisational change issues must be comprehensively addressed. These issues cannot be resolved solely with technical solutions. To support these results, (Huang *et al*., 2003, Huang *et al*., 2004b), suggest that in addition to developing the technical aspects of ERP, more effort is required in understanding the more complex organisational issues involved. Successful ERP implementation requires that the organisation engage in excellent project management. This includes a clear definition of objectives, development of both a work plan and a resource plan, and careful tracking of project progress (Davis and Wilder, 1998, Laughlin, 1993, Sherrard, 1998). The project plan should establish aggressive, but achievable, schedules that instil and maintain a sense of urgency (Laughlin, 1993). A clear definition of project objectives and a clear plan will help the organisation avoid the all-too-common *"scope creep"* which can strain the ERP budget, jeopardise project progress, and complicate the implementation (Davis and Wilder, 1998, Laughlin, 1993, Minahan, 1998). The project scope must be clearly defined at the outset of the project and should identify the modules selected for implementation as well as the affected business processes. If management decides to implement a standardised ERP package without major modifications, this will minimise the need to customise the basic ERP code. This, in turn, will reduce project complexity and help keep the implementation on schedule (Sherrard, 1998).

3.7. Training and Education

Inadequate training has been one of the significant reasons of many ERP systems failure (Gupta, 2000). In ERP implementation projects, despite millions of dollars and hundreds of deployment hours, many projects fail because of the lack of adequate training (Kelley *et al*., 1999). A particular challenge in ERP implementation is to select an appropriate plan for end-user training and education. It is however, important to stress that the main goal of ERP training should be the effective understanding of the various business processes behind the ERP applications (Gupta, 2000). ERP training should address all aspects of the system, be continuous and based on knowledge transfer principles wherever consultants are involved (Davenport, 1998c, Davenport, 1998b). Although an extensive training and education is considered as a CSF by most authors, (Worley *et al*., 2005), state that the appropriation of the system post implementation does not only depend on training; it also requires to define how the IS and the operating personnel will be mutually adapted to each other, not only at the level of the position of a person within the company, but also with reference to his knowledge and competencies. In this context, an unsatisfactory operation of the system may cause irreversible drifts like demotivation, partial use of the system or the introduction of local IS in order to mitigate the supposed deficiencies of the ERP system (Worley *et al*., 2005). Worley arrived at this inference through a university case study. The essence of the case study was to illustrate how ERP is optimised by adapting business processes to the operating personnel by explicitly taking into account, the role, competence and knowledge of human resources. Everyone in the organisation who uses the system needs to be trained on how they need to work, how they relate to the business process and how a transaction ripples throughout the organisation (Davenport, 1998c). Upfront and on-going user support should be provided. The support of the system should be planned before it turns live. The best practice is to break out an on-going user support group from the implementation team as soon as the first module is in production. Outside professional trainers should be brought in to assist team members develop the necessary details and to train in house staff, who then continue to train a large number of users. The Enterprise Systems (ES) training should be incorporated with the other company programmes.

Most organisations lack the internal expertise necessary to develop and deliver an effective ES training programme. Thus, organisations again turn to external resources. ES software vendors provide courses and training focused on their specific products. Often however, this training is generic and not adapted to the organisation's business or culture. Customised training provided by third-party organisations can provide the necessary support during this phase by developing and delivering training and education tailored to the organisation's needs. Case studies indicate that training must provide both the detailed functional training and the overall context and framework of the ES (Avital and Vandenbosch, 2001, Ross, 1999b, Hirt and Swanson, 2001). If users do not understand their role in the ES, they will not be able to effectively utilise the system. To this end, it was decided to ensure that everyone within PDV would receive a basic introduction to the system, which was then followed by more specialised communication sessions for everyone who would have to interact with the system as part of their daily activities. Teaching each of the various user groups how the ERP system works is important in creating awareness (Stratman and Roth, 1999). A great deal of effort went into describing the general inputs and outputs of the system. Hands-on training is an important driver of ERP implementation success (Russo et al., 1999). Training offers a good opportunity to help users adjust to the change that has been introduced by the ERP system, and helps build positive attitudes toward the system. Further, training provides hands-on experience for the users: they appreciate the quality attributes of the system and its potential benefits. Within the training sessions, the department with responsibility for providing the necessary data were clearly identified, and it was ensured that everyone received the training they needed in order to operate the system effectively. Throughout all of this, a good deal of political skill was required in order to address individual concerns in a sensitive and delicate manner. For those persons who voiced concerns about interacting with the new system, they were given assurances that the system represented an opportunity for advancing their skill and knowledge set and therefore in reality it represented an opportunity for advancing their career paths. By ensuring that key-leaders and management personnel were involved throughout all aspects of the training and communication sessions, and by convincing them to effectively participate in the implementation process, which made them feel that they were key players, ensured their valuable commitment, this paved the way for acceptance of the system by all the key influential groups within PDV.

3.8. Legacy System Management

For an ERP implementation to be successful, the complexities of existing business legacy systems must be successfully managed (Lee *et al.*, 2003), and customisation of the ERP system should be avoided as much as possible (Bajwa *et al.*, 2004, Murray and Coffin, 2001, Light, 2001, Rosario, 2000, Shanks *et al.*, 2000, Sumner, 1999). Customising an ERP system has been associated with an increase in IT costs, a longer implementation time, and the inability to benefit from the vendor's software maintenance and upgrades. To justify customising the system, a strong business case on the loss of competitive advantage should be developed (Somers and Nelson, 2003), and the overall architecture of the system must be configured before the deployment, and defining the architecture before the implementation prevents reconfiguration at later stages (Wee, 2000). Rigorous and sophisticated testing is very important for the success of the implementation (Al-Mashari *et al.*, 2003, Rosario, 2000). In order to achieve the full benefits of an ERP system, integration of data from previously used systems and with the company's other systems is critical (Somers and Nelson, 2001). To ease the integration process, organisations may develop their own middleware (Bingi *et al*., 1999), or employ Enterprise Application Integration (EAI) which uses special middleware that serves as a bridge between different applications for system integration (Lee *et al*., 2003). Many companies began installing ERP systems in order to eliminate patchwork of their legacy systems and improve the interactions and communications with their customers and suppliers (Kogetsidis *et al*., 2008). From a business standpoint, the benefits that a properly selected and implemented ERP system can offer an organisation include time and cost reduction in business processes, faster transaction processing, improvement of operational performance, financial management and customer service, Web-based interfaces and more effective communication (Kogetsidis *et al*., 2008). Legacy systems encapsulate the existing business processes, organisation structure, culture, and IT. Therefore, they cannot be controlled by a company in the same way as the other variables in the model. Inevitably, they determine the amount of organisational change required to successfully implement an ERP system and will dictate the starting point for implementation. By evaluating the existing legacy systems capabilities, it is possible to define the nature and scale of problems that are likely to be encountered. This should then influence the choice of ERP strategy. For example, if the legacy systems are extremely complex, with multiple technology platforms and a variety of procedures to manage common business processes, then the amount of technical and organisational change required is high. If the organisation already has common business processes and a simple technical architecture, change requirements are low.

Legacy systems are not separate problems since their design and operation bind so many components of a business, such as work flow and processes. Most implementation models ignore legacy systems and underestimate their importance with regard to the possible choices available within the ERP strategy. It has been noted by (Roberts and Barrar, 1992), and (Adolph, 1996), that legacy systems include the existing IT infrastructure (hardware and software), business processes, organisational structure and culture. In ERP implementation, existing legacy systems have to be carefully defined and evaluated to determine the nature and scale of problems that an organisation may encounter during implementation (Holland and Light, 1999a). It is important that the planned infrastructure is reliable and becomes available within the scheduled time frame. (Rao, 2000). Holland and Light stress the need to carefully manage legacy systems in ERP implementation. They suggest that if organisational legacy systems are very complex (with multiple platforms and a variety of procedures to manage processes), then the amount of technical and organisational changes required is likely to be high. Indeed, the problem of legacy systems centres on the fact that in most companies, data are not kept in a single repository, but rather spread across dozens or even hundreds of separate computer systems, each housed in an individual function, business unit, region, factory, or office. Each of these legacy systems may provide valuable support for a particular business task. However, when they are considered in combination, they represent one of the heaviest hindrances on business productivity and performance (Davenport, 1998c, Davenport, 1998b). It is important, therefore, that an organisation approaches the transition of legacy systems carefully, and with a comprehensive plan. One of the complexities associated with ERP implementation is related to the cross-module integration nature of the system (Soh *et al*., 2000). Though there are middleware technologies that can be used to integrate software applications from several vendors to the ERP backbone, they are not available for all ERP systems (Bingi *et al*., 1999). Moreover, middleware vendors often tend to focus on the technical aspects of application inter-operability rather than linking business processes together, and, in many cases, organisations have to develop their own interfaces for commercial software applications. Even maintaining the integration mix requires an excessive and on-going expenditure of resources. It is found that organisations spend up to 50 per cent of their IT budgets on application integration (Radding, 1998). When it comes to maintaining the system, IS personnel are faced with the challenge of managing and keeping it integrated with other organisational systems (Bingi *et al*., 1999).

The organisation's propensity for change should have a bearing on the ERP strategy choice. For example, it is possible to implement a skeleton version of a software package initially, and then gradually add extra functionality once the system is operating and the users are familiar with it. The main advantages of fast-track implementations are speed and simplicity. By adopting a skeleton approach, the roll-out of an ERP system across multiple sites can be achieved in a much shorter timeframe; this maintains the momentum of the project and also gives fewer opportunities for users to try and replicate their legacy systems onto the new ERP platform. ERP systems are transaction systems meant to provide companies with a seamless integration of data for organisations and it appears that this benefit is likely to be understood by company employees regardless of their position within the organisation. What is less understood, at least in the minds of the end-users, is the exact nature of the technology that they are engaging with. A knowledge gap thus exists between user-managers and end-users. A possible explanation for this gap might be the allegiance that end-users have toward the legacy systems that ERP systems are meant to replace. Because they have been using these systems for quite a while, they are perhaps intimately familiar with the technology involved, and it can present a challenge to convince them, that the replacement technology offers a number of superior benefits.

3.9. System Testing and Evaluation

As the implementation of any application system cannot be realised in a single step, the new functionalities are better tested both alone and in conjunction with the existing functionalities (Apperlrath and Ritter, 2000). In ERP implementation, going-live on the system without adequate and planned testing is a recipe for an organisational disaster (Computer Technology Research Corporation, 1999). The testing and validation of an ERP system is important to ensure that the software works technically and that the business process configurations are practical. When business processes are up and running, an important test of the system, is whether the processes described and represented in the application system, actually match with the processes taking place within the organisation (Apperlrath and Ritter, 2000). In the case of Guilbert, (Gibson *et al*., 2001), testing was considered important because the new system were found not to be working in parallel with the company's older systems. A testing process was undertaken as the system was configured, and then the entire system was tested by user trials (Gibson *et al*., 2001). For the purpose of measuring and improving business performance, several costing techniques have been developed to provide more accurate cost information, primarily by cutting the link between internal management reporting and the demands of external regulations (Dixon *et al*., 1990). However, several authors such as (McKinnon and Bruns, 1992), suggest that management accountants must pass responsibility for performance measurement to those responsible for achieving the performance (i.e., process owners). This has led to the development of non-financial measures of performance to achieve a balance, between both financial and operational measures. (Grady, 1991), supports this balanced perspective and (Kaplan and Norton, 1992), propose a *"Balanced Scorecard"* of measures along five perspectives, namely strategic planning, financial, customer, internal business, and innovation and learning. This approach appears to be gaining in popularity, as its applicability continues to spread across different fields.

3.10. Change Management

Innovation and change management play an increasingly important role in sustaining "*leading edge"* competitiveness for organisations in times of rapid change and increased competition. *"Discontinuous change requires discontinuous thinking. If the new way of things is going to be different from the old, not just an improvement on it, then we need to look at everything in a new way."* (Henry, 2001). The process of monitoring and evaluating change management strategies for ERP implementation is yet another aspect of ERP implementation that must be seriously considered, along with having a performance measurement system to ensure that the desired business outcomes are achieved (Al-Mashari and Zairi, 2000a). It is important to have a performance system to monitor the progress of ERP change management efforts. The point is made by (Huang *et al*., 2003), that although ERP systems have been progressively developed over at least a decade, the continual pace of change in organisations and their environments has resulted in *"complex technical organisational challenges, which combined with cultural and political issues, have made the integration process a very challenging task"*. Improvement strategies, such as ERP implementation, commonly involve change. Hence, responsiveness to internal customers is critical for an organisation to avoid the difficulties associated with this change (Al-Mashari and Zairi, 2000a). In order to assist top management with the complex organisational problem of workers' resistance to ERP implementation (Aladwani, 2001), suggests an integrated, process-oriented conceptual framework consisting of three phases; knowledge formulation, strategy implementation, and status evaluation. This model is illustrated in Figure 24.

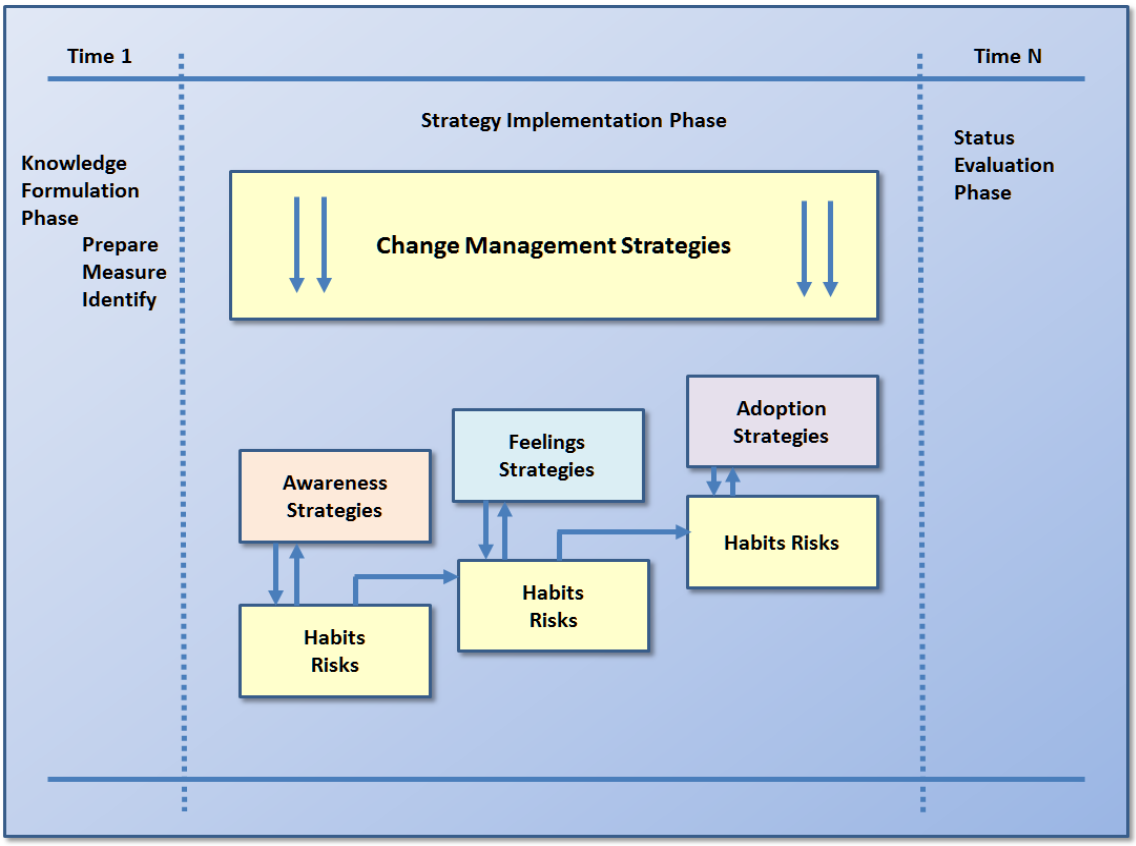


Figure 24: Framework for Managing Change. *Source*: *(Aladwani, 2001)*

The first step in effectively managing change introduced by IT is to identify and evaluate the attitudes of individual users and influential groups (Aladwani, 1998). This analysis should address such questions as:

- Who are the resisting individuals and/or groups?
- What are their needs?
- What beliefs and values do they have?
- What are their interests?

The answers to these fundamental questions may offer a good starting point in determining the sources of employees' resistance to the ERP system. According to (Hultman, 1979), employee-raised facts, beliefs, and values are good indicators of what may cause their resistance to change. It is imperative that top management makes sure that workers' anxiety and resistance to ERP is under control. Management within PDV were critically aware of the potential problems that could be encountered during the deployment phase of the ERP system and therefore, they initiated a number of strategies to overcome users' resistance to the ERP system, and to convince as many users as possible to adopt it. In a number of cases, ERP implementation has failed because of lack of communication (Al-Mashari and Zairi, 2000a). Knowledge about what the system can deliver to the organisation and its workers can build anticipation, and consequently lower resistance for the system. It may be the case that, some users may raise issues about their computer illiteracy, or may say that they have spent many years doing an excellent job without help from an ERP system. Whereas, other users may develop beliefs that their jobs will be threatened by the new system, or that they will not know how to do the job within the scope of such a system. Others may stress values such as the importance of existing power and authority structures, which may be challenged by the introduction of a new ERP system. In order to change the potential negative attitudes of potential users of ERP systems, management must first try to affect the cognitive component of users' attitudes. A recognised strategy for achieving this goal is through the use of effective communication channels. One effective communication strategy is to inform potential users of the benefits of ERP. This is a well-established technique, used by marketing departments, when they wish to communicate the benefits of a product, rather than its attributes, to customers, in order to draw their attention and heighten their realisation (Williams, 1981). Additional communication strategies can provide induction and training classes which provide a description of how the implemented ERP system will work. In the marketing context, (Lazarus and Wexler, 1988) notes, that marketers use this strategy to ensure a receptive attitude from users of a new product. Providing awareness to the various user groups of how the ERP system works is important (Stratman and Roth, 1999), and from the outset, management should explain to potential users how the ERP system is going to work. Management should clarify the general inputs and outputs of the system, make it clear, which departments will provide the data, and define the computer knowledge needed to operate the system. In all cases, it is of paramount importance that the support staff responsible for executing these communication strategies possess adequate political skills (Aladwani, 1999), so that the awareness stage ends up in accordance with the plan.

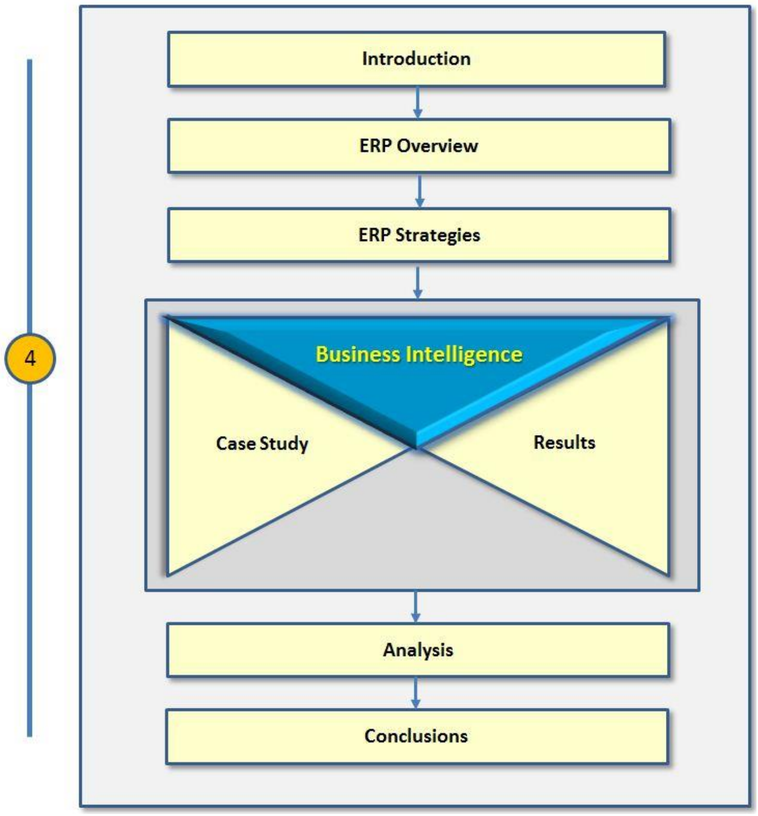
Another marketing strategy that can be adopted for use in relation to this particular issue, is one that has been proposed by the management and marketing academic Michael Porter (Porter, 1998), proposes the low-cost strategy as one that can be used by marketers to help an organisation survive in a competitive environment. This strategy has a useful comparison within the communication strategy for ERP. If management wants the new system to be adopted by the users, then users' adoption costs should be kept to a minimum. If management can convince ERP users that their net outcome of the adoption process will be positive, then they will develop strong feelings toward accepting and adopting the new system (Amoako-Gyampah, 1999). Differentiation is yet another strategy that can be implemented within the same vein. The point has been made by (Aaker, 1998) that, the *"quality"* option, is an important basis for a product differentiation strategy. In the ERP context, the users' perceived high quality of the ERP system is one that can be utilised to have a positive impact on their attitudes toward that system. Generally, system users do not scientifically measure quality attributes of the system rather each user constructs his or her perception of the system depending on how user friendly the system appears to be. The psychological aspects of change management, and worker resistance with regard to the implementation of IT projects is further discussed within the analysis section of this thesis. The process of monitoring and evaluating change management strategies for ERP implementation is the last component of the suggested framework. It is also important, to have a performance system in place, to monitor the progress of ERP change management efforts, along with possessing a performance measurement system that ensures that the desired business outcomes are achieved (Al-Mashari and Zairi, 2000a).

The status evaluation phase should provide feedback information to top management in a dynamic manner. In order to be useful, the feedback should be timely, accurate, and systematic. Based on the evaluation phase outcome, top management should take action as indicated by the nature of the feedback. The feedback may be positive, which means that the policies which have been established, be maintained. Alternatively, the performance feedback may be negative. Management may find that there is still strong workforce resistance to the operational changes resulting from ERP implementation. In such a case, top management should make every effort to understand what has gone wrong. Senior management may wish to re-identify users' needs and re-evaluate the execution of adopted change management strategies to find an acceptable fit between the two. Project evaluation measures must be included from the beginning. If system implementation is not tied to compensation, it will not be successful. If, for example, all managers receive bonuses, irrespective of the extent to which the programme has been implemented, than a successful implementation is less likely. Management, vendors, the implementation team, and the users must share a clear understanding of the goal. If someone is unable to achieve agreed-upon objectives, they should, either receive the needed assistance or be replaced. When teams reach their assigned goals, rewards should be presented in a very visible way. The project must be closely monitored until the implementation is completed. The system must be monitored on an on-going basis and be measured (Hutchins, 1998). Management and other employees often assume that performance will begin to improve as soon as the ERP system becomes operational. Instead, because the new system is complex and difficult to master, organisations must be prepared for the possibility of an initial decline in productivity, as familiarity with the new system increases, improvements will occur. Thus, realistic expectations about performance and time frames must be clearly communicated (Langenwalter, 2000, Oden *et al*., 1993).

Chapter Four

Business Intelligence

"An organisation's ability to learn, and translate that learning into action rapidly, is the ultimate competitive business advantage." - Jack Welch, General Electric CEO



From the previous chapter, it can be seen that taking the decision to implement ERP within an organisation, is not a trivial one, and there are many complex issues which must be taken into consideration. This makes many senior executives wary of deciding upon an ERP solution for their entire organisational needs, as they are aware of the limitations that the technology can offer. This creates the need to look for an alternate or complimentary technology platform, which can be used to provide more flexible solutions with regard to their *"Enterprise Solution"* needs. This chapter will explore the area of IT/S which incorporates some of the newer and emerging technologies which can be employed as an alternate to, and also to complement ERP. This chapter introduces the components that are now considered to be the building blocks of that aspect of organisational operations that is now referred to as BI.

4.1. Business Intelligence Structure

Many organisations now recognise that in order to take their business to the *"next level"* in terms of SCM and CRM, it is essential to employ aspects of BI within their operations. Key elements of the BI structure include; the creation of a Data Warehouse (DW), along with, data mining, which is a set of tools and techniques, which provide the ability to obtain *"actionable knowledge"* from within it. The data contained within a DW will come from numerous sources, and therefore, it will not all be of the same structure. In order to make all of the data usable, it is necessary to change, or transform it into a common structure. In order to do this, a methodology referred to as Extract Transform and Load (ETL) is employed. The ability to be able to query and analysis the data base from a number of different perspectives is a key managerial requirement. A set of protocols referred to as, On Line Analytical Processing (OLAP) facilitates in fulfilling this requirement, and in particular how data is queried using the *"OLAP Data Cube"*. Within this chapter, the tools and methodologies used to accomplish these tasks are discussed.

Although the implementation of ERP offers many advantages, organisations should not rely upon it, to manage all aspects of their supply chain, and in particular those aspects of it which relate to CRM. ERP has a rigid system design and is unable to deal with uncertainty (Koh *et al*., 2004, Moon and Phatak, 2005). One of the main objectives of utilising an ERP system is to merge corporate-wide data from various sources so that corporate employees, external partners, suppliers, and distributors can make good use of the data. In the current environment, the need of data distribution across the company boundary is extensively increasing and analytical functions are no longer the province of a select group of users within the organisation. Therefore, organisations need to distribute the analytic capability to various operational levels, targeted at specific business needs via key performance indicators (KPIs), dynamic reporting, and real-time analytics (Agostino, 2004), and in reality, ERP systems do not seem to provide all of the required functionality, which results in a number of additional challenges which need to be addressed. Usually, ERP systems do not offer a reporting service with regard to, product line revenue analysis. Also, ERP systems are not capable of providing ad-hoc reporting services and online views of business operations are not supported, neither do ERP systems support cost allocation, and profit and loss reporting, and complex analytic solutions, require additional software or systems. Another challenge relates to aspects of budgeting. Corporate budgets can be identified and controlled in various ways. Budgetary changes however, need to be handled outside the ERP system, this results in delays, which can mean that the budget data within the ERP system soon becomes obsolete. Another weakness of ERP systems can result from their limited integration capability with other systems. For example, CRM and, sales force automation systems' forecasting capability, can be used to empower business decisions, if they can be integrated with ERP systems. Also, the budgeting tools are often not well integrated with ERP systems, which cause concerns with regard to financial data consistency.

ERP's predecessors, MRP and MRPII, are still very popular, particularly amongst SME's (Loh and Koh, 2004). They are mainly used for production planning in manufacturing enterprises. For businesses wishing to integrate their operations with suppliers and customers in the supply chain, Supplier Relationship Management (SRM) and CRM tools and technologies, have been adopted (Burn and Ash, 2005). Other systems and technologies, such as Radio Frequency Identification (RFID), mobile technology, wireless technology, and intelligent agent-based knowledge management systems can also be utilised to improve the process of ordering and providing product traceability within the supply chain (Koh and Gunasekaran, 2006). These tools can reduce the problems of uncertainty since a more accurate view of the flows of order, part and product can be achieved. Some enterprises combine these systems in order to provide the best performance in logistics and SCM. The additional challenges that many organisations now face, which goes beyond the capability of ERP systems, has led many organisations to turn towards BI solutions to meet these additional needs. The ability to extract and present information in a meaningful way is vital for any business management application. BI enables organisations to make better decisions faster than ever before by providing the right information to the right people at the right time. Employees increasingly find that they suffer from information overload, and that they need solutions that provide the analysis to effectively make decisions. Whether they are working on the strategic, the tactical, or the operational level, BI applications provides tools to make informed decisions a more natural part of all employees everyday work experience (BĂLĂCEANU, 2007). BI applications and technologies are used to gather, provide access to, and analyse data and information about company operations. BI systems can help companies have a more comprehensive knowledge of the factors affecting their business, such as metrics on sales, production, internal operations, and they can help companies to make better business decisions. CEOs and CIOs now, realise that data is one of their more valuable assets, because data is used to generate information. BI is a process that includes two primary activities, which are: getting data in and getting data out of the data warehouse, as illustrated in Figure 25.

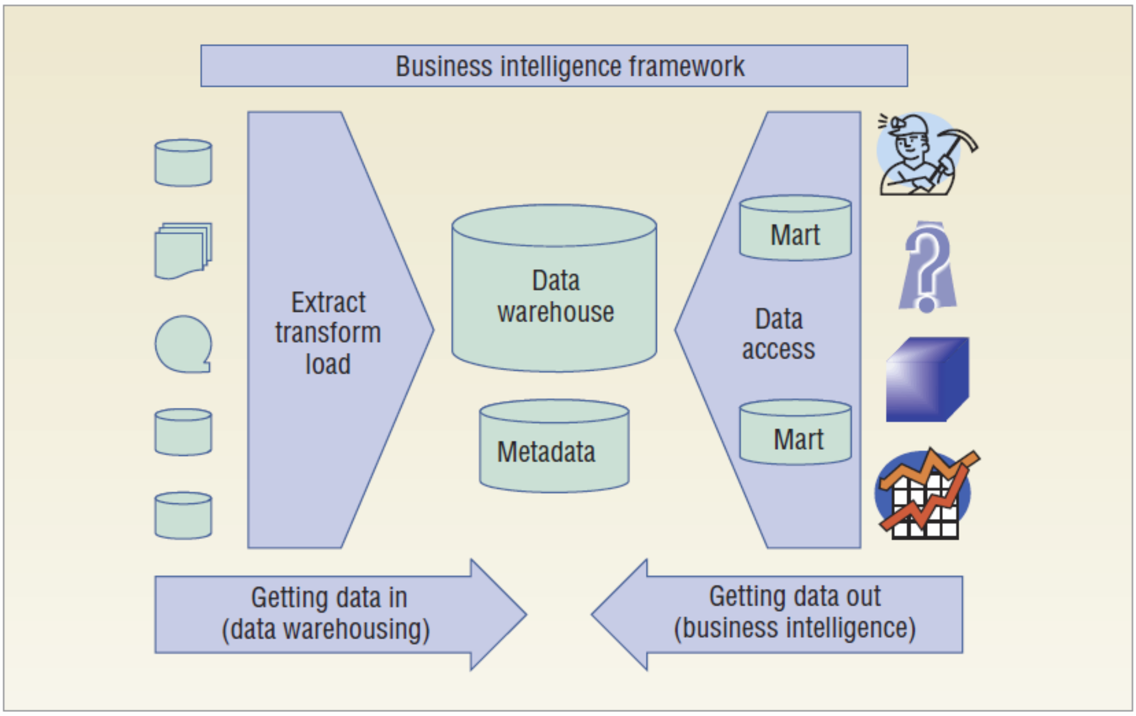


Figure 25: Business Intelligence Framework. *Source:(Watson and Wixom, 2007)*

The increasing need for prompt decision making leads to the generation of information at an ever increasing pace. Data analysis, reporting, and query tools in BI systems can help business users wade through a sea of data to generate valuable information from it (Chee *et al*., 2010). BI can be defined as the process of turning data into information and then into knowledge. Knowledge is typically obtained about customer needs, customer decision making processes, the competition within the relevant business sector, conditions in the industry, and general economic, technological, and cultural trends. BI is not a new technology, rather, it is; *"a natural outgrowth of a series of previous systems designed to support decision making"*. BI was born within the industrial world in the early 90s, to satisfy management's requirement for efficient and effective analysis of the enterprise data in order to better understand the situation of their business, in an effort to improve the decision making process. BI is designed to support the process of decision-making (Gray, 2003). In the mid-90s BI became an object of interest within the academic world, and more than ten years of research managed to transform an assortment of emerging techniques into a well-founded approach to information extraction and processing. Eventually, the main results obtained on topics such as OLAP, multidimensional modelling, design methodologies, optimisation and indexing techniques converged to define the modern architectures of DW systems, and were absorbed by vendors to form a variety of software solutions (Golfarelli *et al*., 2004), which enable business decision making and analysis. The overall architecture of a BI solution is represented in Figure 26.

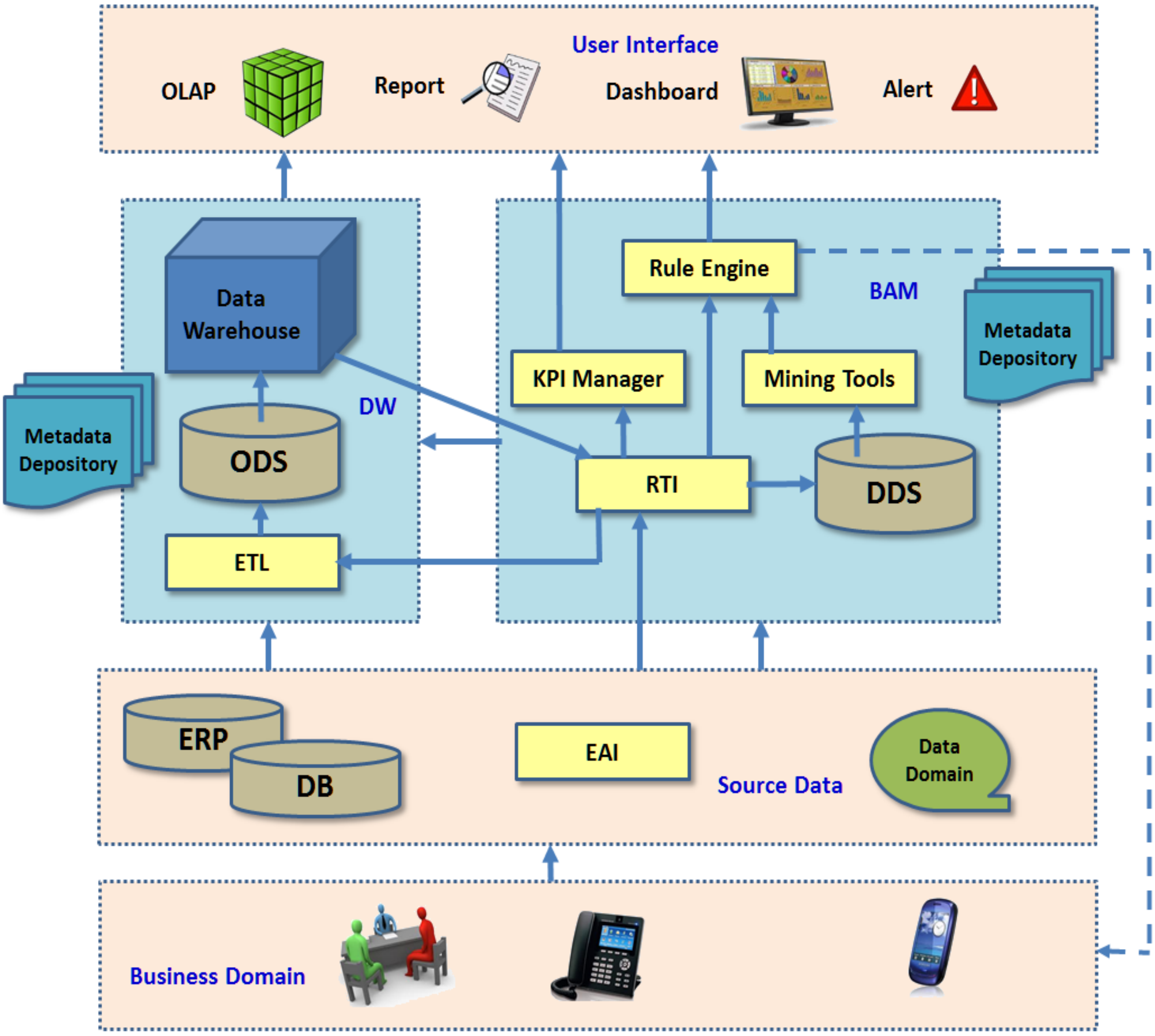


Figure 26: Business Intelligence Architecture. *Source:(Golfarelli et al., 2004)*

After spending years and possibly millions of investment dollars in ERP-style systems, many companies now store vast amounts of transactional data. The role of BI is to extract the information deemed central to the business, and to present or manipulate that data into information that is useful for managerial decision support. In their simplest form, these tools permit a decision maker to access an up-to-date, often consolidated, view of business performance. According to Gibson *et al*, the term BI and its key concepts originated within the Gartner Research group in 1989 (Gibson *et al*., 2004). Howard Dresner of Gartner Research, who is also widely recognised as the father of BI, first proposed BI as an umbrella term to describe *"a broad category of software and solutions for gathering, consolidating, analysing, and providing access to data in a way that lets enterprise users make better business decisions"*. However, research has indicated that, the term BI is really not that new, and that it was used as early as 1958 by (Luhn, 1958), in an IBM journal article entitled *"A Business Intelligence System"*. Using a Selective Dissemination of Information (SDI) technique, Luhn's paper presents a concept which is similar to the modern notion of BI (Chee *et al*., 2010). BI is now recognised as an important growth area in IT. Despite recent downturns and slowdowns within the IT industry, BI software vendors continue to report substantial profits (Chen, 2002, Lei, 2002, Whiting, 2003), and this is in part due to the fact that as business profits decline, organisations are recognising that the provision of quality information is one of the keys to gaining competitive advantage. Supported by increasing improvements in storage, data warehousing and OLAP solutions, the BI market is expected to continue to rise into the coming years (Gibson *et al*., 2004). There is very little consensus on a definition for BI, often it depends on who is defining it, and frequently, what particular aspect of ERP that they are trying to promote. Table 5 below lists a number of definitions that have been proposed within the literature.

Business Intelligence Description
Business intelligence is the process of taking large amounts of data, analysing that data, and presenting a high-level set of reports that condense the essence of that data into the basis of business actions, enabling management to make fundamental daily business decisions (Stackowiak *et al*., 2007).
BI is a way and a method of improving business performance by providing powerful assists for executive decision maker to enable them to have actionable information at hand (Cui *et al*., 2007).
BI technology is based on the method of information delivery; reporting, statistical analysis, ad-hoc analysis and predicative analysis. *"The process of collection, treatment and diffusion of information that has an objective, the reduction of uncertainty in the making of all strategic decisions"* (Zeng *et al*., 2006).
The basic characteristic of a BI tool is the ability to collect data from heterogeneous source, to possess advance analytical methods, and the ability to support multi user demands (Tvrdikova, 2007).
BI includes an effective data warehouse and also a reactive component capable of monitoring the time

critical operational processes to allow tactical and operational decision-makers to tune their actions according to the company strategy (Golfarelli *et al*., 2004).
BI is the result of in-depth analysis of detailed business data, including database and application technologies, as well as analysis practices (Gangadharan and Swami, 2004).

Table 5: Business Intelligence Description: *Source (Sturdy 2012)*

Other experts have described BI as a *"business management term used to describe applications and technologies which are used to gather, provide access to analyse data and information about an enterprise, in order to help them make better informed business decisions"*. It is imperative that firms have an in depth knowledge about factors such as the customers, competitors, business partners, economic environment, and internal operations to make effective and good quality business decisions. BI enables firms to make these kinds of decisions. In modern businesses, increasing standards, automation, and technologies have led to vast amounts of data becoming available. DW technologies have set up repositories to store this data. Improved ETL tools have increased the speed of data collection. OLAP reporting technologies have allowed faster generation of new reports which analyse the data. BI has now become the art of sifting through large amounts of data, extracting pertinent information, and turning that information into knowledge upon which actions can be taken (Ranjan, 2009). In terms of on-line decision making, the thrust of BI is to provide a near instantaneous response. Most of the time however, it is the ability that it provides to shrink the time frame, so that the intelligence is still useful to the decision maker when the decision time comes. In all cases, use of BI is viewed as being proactive. Essential components of proactive BI according to are (Langseth and Vivatrat, 2003) are:

- Real-time data warehousing.
- Data mining.
- Automated anomaly and exception detection.
- Proactive alerting with automatic recipient determination.
- Seamless follow-through workflow.
- Automatic learning and refinement.
- Geographic IS.
- Data visualisation.

BI is a natural outgrowth of a series of previous systems designed to support decision making. The emergence of the DW as a repository, the advances in data cleansing, the greater capabilities of hardware and software, and the boom of Internet technologies all combine to create a richer BI environment that was not previously possible. BI pulls information from many other systems. Figure 27 depicts some of the IS that are used by BI (Negash, 2004).

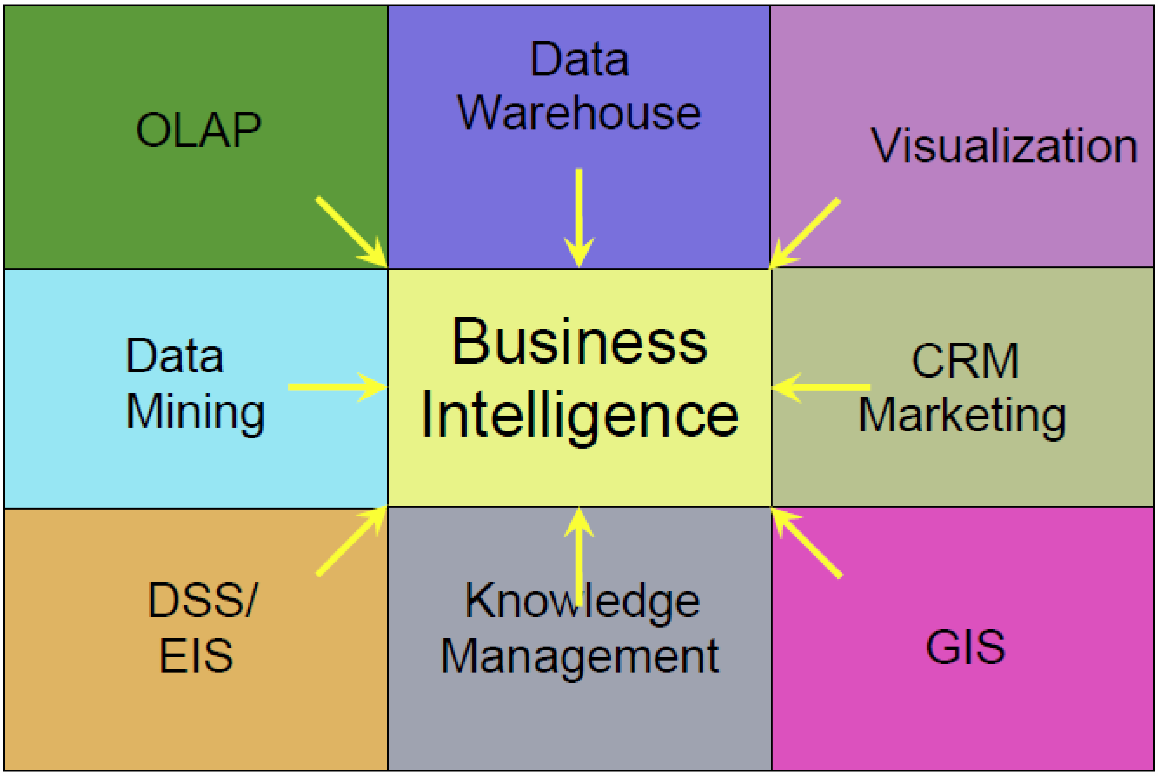


Figure 27: Information Systems Employed by BI. *Source:(Negash, 2004)*

4.2. Data Warehousing

Data warehousing is one of the key developments in the IS field. Only 10 years ago, warehousing initiatives were just beginning in a few visionary firms. Today, virtually all large organisations have warehouses and many are moving to later generations of warehouses (Eckerson, 1998). A DW is a large physical database that holds a vast amount of information from a wide variety of sources. Originally DWs were used, just as the name implies, for warehousing transactional and operational data to off-load the production systems each year. In a way it was where data went to die. That is until knowledgeable business analysts started to use the archive to do analytical reporting, year over year analysis, and use many other modelling technologies to understand where the company had been and what had affected its performance. Data warehousing is often considered to be new technology, when in in reality, it is now approaching 20 years since the first warehouses were developed. In the early eighties, companies, driven by mainframe computers, went through an annual process of archiving last year's operational data, to clear room for the coming year. Usually, this data was archived to magnetic tape. Later, companies were able to add capacity and keep two or more years of data on-line. Today, it is possible to buy a solid state stick disk, with two terabytes of capacity storage for under €200. This allows for new functionality in trend analyses, year over year reporting, and regression analysis. Data warehousing consists of data importing and exporting components, which are responsible for accessing, transforming, distributing, storing, and exporting the data and information. The data warehouse has been described by (Devlin, 1997), as a single, complete, and consistent store of data obtained from a variety of sources and made available to end users in a way they can understand and use in a business context. Information is one of the most valuable assets of an organisation and when used properly can assist in intelligent decision-making that can significantly improve the functioning of an organisation. DW according to (Inmon, 2009), is a recent technology that allows information to be easily and efficiently accessed for decision-making activities (Kumar Madria, 2001). Since the mid-1980s data warehouses have been developed and deployed as an integral part of a modern decision support environment. A data warehouse provides an infrastructure that enables businesses to extract, cleanse, and store vast amounts of corporate data from operational systems for efficient and accurate responses to user queries (Inmon, 2009). The multi-dimensional DW is the core of the BI environment. Basically it is a large database containing all the data needed for performance management. The modelling techniques used to build up this database are crucial for the functioning of the BI solution. Typical characteristics of the data warehouse are that it should be:

- Subject-oriented: the data in the database is organised so that all the data elements relating to the same real-world event or object are linked together.
- Time-variant: the changes to the data in the database are tracked and recorded so that reports can be produced showing changes over time.
- Non-volatile: data in the database is never over-written or deleted, once committed, the data is static, read-only, but retained for future reporting.
- Integrated: the database contains data from most or all of an organisation's operational applications, and that this data is made consistent.

In order to gain a better understanding of what a multi-dimensional DW is, it is important to understand the multi-dimensional modelling techniques that assure the above characteristics. A DW is the main repository of the organisation's historical data. In effect, it contains its corporate memory. Before the advent of data warehousing software, the problems that many users encountered when trying to derive useful information for decision support from their operational databases often meant intolerable delays in the production of reports and query results, which are needed for timely decision making. Although Relational Database Management Systems (RDBMSs) with Structured Query Language (SQL) has provided substantial data independence and ease-of-use benefits for query and update applications, supporting both operational and decision-support applications with a single database designed for Online Transaction Processing (OLTP), this approach was only marginally successful (Bontempo and Zagelow, 1998). Data mining applications utilise the information stored in the DW to generate business-oriented, end-user-customised information (Ma *et al*., 2000). Decision Support Systems (DSS) are becoming increasingly more critical to the daily operation of organisations. DW, which is an integral part of this, provides an infrastructure that enables businesses to extract, cleanse, and store vast amounts of data. DW involves the acquisition of data, from multiple internal and external sources and the management of this data in an integrated, query-only database. The architecture of a DW is represented in Figure 28.

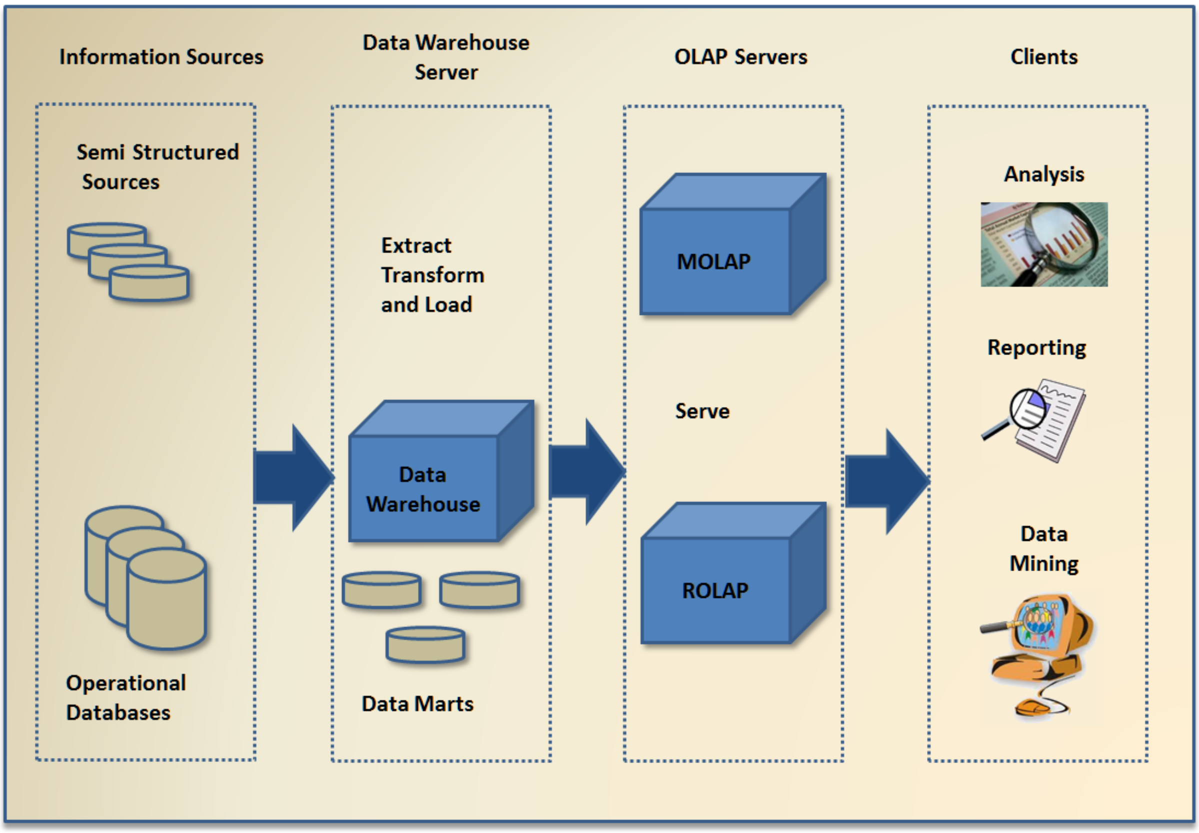


Figure 28: Data Warehouse Architecture. *Source: (Hammer et al., 1995)*

Flexible reporting and analysis tools are provided for business users to extract timely and accurate information to support their managerial and decision-making process (Ferguson, 1997).

The basic purpose of a DW is to empower the knowledge workers with information that allows them to make decisions based on a solid foundation of fact. However, only a fraction of the needed information exists on computers, in many cases, the vast majority of a firm's intellectual assets exist as knowledge in the minds of its employees. What is needed is a new generation of knowledge-enabled systems that provides the infrastructure needed to capture, cleanse, store, organise, leverage, and disseminate not only data and information but also the knowledge of the firm (Nemati *et al*., 2002). Knowledge management is the practice of adding actionable value to information by capturing tacit knowledge and converting it to explicit knowledge; by filtering, storing, retrieving and disseminating explicit knowledge; and by creating and testing new knowledge. In this context, tacit knowledge includes the beliefs, perspectives, and mental models so ingrained in an person's mind that they are taken for granted (Nonaka and Takeuchi, 2007).

The DW frees the IS organisation from having to constantly programme custom reports and queries. The IS organisation designs the data warehouse so that users can easily recognise the data they want, and they can then use easy query tools for creating their own queries. Every DW has a structure and methodology that performs an extensive transformation of the data (Ma *et al*., 2000). Data warehousing is undergoing a rapid time compression where new functionality is being built into new products, old products are being reengineered into project suites and even hardware configurations have been designed and refined to provide optimum processing power and speed for OLAP applications. It is a full time job to keep up with the technologies and to make sensible purchasing decisions as the industry is in a state of constant flux. It is important to select the right reporting tools and a minimum of tools at that. Studies have shown that many companies utilise over seven reporting tools for various department systems. An enterprise-wide implementation attempt should settle on a single integrated product suite solution to assure the greatest chance at success, quickest Return on Investment, lowest Total Cost of Ownership, and rapid value delivery (Crowley, 2002).

4.3. Data Mining

The use of sophisticated and computationally intensive analytical methods are expected to become even more commonplace with recent research breakthroughs in computational methods and their commercialisation by leading vendors (Smyth *et al*., 2002, Bradley *et al*., 2002, Grossman and Mazzucco, 2002), and the requirement to garner usable knowledge from this data has led to the development of a field of study referred to as Data Mining (DM). In many instances DM is a secondary analysis over data collected for some other purpose. For example, in supermarket data, part of the primary information that is collected is used to work out the bill the customer is charged. However, the stored data can then subsequently be submitted to analysis looking for customers' transaction patterns. DM is defined as a sophisticated data search capability that uses statistical algorithms to discover patterns and correlations in data (Newton, 2001). Within practically all areas of business, a virtual explosion in data has occurred in the last 20 to 30 years, as a result of the widespread availability and use of powerful computer systems for data storage and analysis. The size of modern databases is truly staggering, as illustrated by the following examples. Barclaycard, the UK.'s largest credit card company, carries out 350 million transactions a year. However, this is relatively small in comparison to the American retailer Wal-Mart, who's DW now exceeds 500 terabytes, and which carries out over eight billion transactions a year. More strikingly still, according to (Cortes and Pregibon, 1997), AT&T carries over 70 billion long distance calls annually (Hand *et al*., 2000). DM is the automated process of discovering previously unknown useful patterns in structured data. A working definition of DM is *"the discovery of interesting, unexpected, or valuable structures in large datasets"* (Hand *et al*., 2001). DM can be divided into two main classes of tools: model building and pattern discovery. Model building is a high level global descriptive summary of datasets, which in modern statistics include: regression models, cluster decomposition and Bayesian networks. Models describe the overall shape of the data (Hand, 2007), a "*pattern*", is a local structure, in a possibly vast search space, describing data with an anomalously high density compared with that expected in a baseline model. Patterns are usually embedded in a mass of irrelevant data (Hand *et al*., 2000). The DW is therefore a perfect environment in which to conduct data mining exercises. To a certain extent OLAP, in which users slice and dice, pivot, sort, filter data to see patterns is a form of human, visual data mining. However, the human eye can only see a limited amount of dimensions (mostly three) at the same time and therefore, cannot discover more complex relationships. Also discovering relationships between different attributes of dimensions is a time consuming exercise. Rapid advances in information and sensor technologies, along with the availability of large-scale scientific and business data repositories or database management technologies, combined with breakthroughs in computing technologies, computational methods and processing speeds, have opened the floodgates to data dictated models and pattern matching (Fayyad and Uthurusamy, 2002, Hand *et al*., 2001). In the evolution from business data to useful information, each step within the process is built on the previous ones. Table 6 illustrates the evolutionary stages from the perspective of the user.

Stage	**Business question**	**Enabling technologies**	**Product providers**	**Characteristics**
Data Collection (1960s)	What was my average total revenue over the last five years?	Computers, tapes, disks	IBM, CDC	Retrospective static data delivery
Data Access (1980s)	What were unit sales in New England last March?	Relational Databases (RDBMS), Structured Query Language (SQL), ODBC	Oracle, Sybase, Informix, IBM, Microsoft	Retrospective dynamic data delivery at record level
Data Navigation (1990s)	What were unit sales in New England last March? Drill down to Boston	On-line analytic processing (OLAP), multidimensional databases, data warehouses	Pilot, IRI, Arbor, Redbrick, Evolutionary Technologies	Retrospective dynamic data delivery at multiple levels
Data Mining (2000)	What's likely to happen in Boston unit sales next month? Why?	Advance algorithms, multiprocessor computers, massive databases	Lockheed, IBM, SGI, numerous start-ups	Prospective, proactive information delivery

Table 6: The Evolutionary Stages of Data Mining. *Source: (Thearling, 2001)*

DM compliments other data analysis techniques such as statistics, OLAP, spread-sheets, and basic data access. In simple terms, DM is a method that can be employed to find meaning in data. DM is actually part of a larger process called *"knowledge discovery"* which describes the steps, that must be taken to ensure meaningful results are obtained from the dataset. DM software does not however, eliminate the need to know the business, understand the data, or be aware of general statistical methods. DM does not find patterns and knowledge that can be trusted automatically without verification. DM helps business analysts to generate hypotheses, but it does not validate the hypotheses (Rygielski *et al*., 2002). The challenge is to be able to utilise the available information, to gain a better understanding of the past, and predict or influence the future through better decision-making (Ganguly and Gupta, 2005). The core components of DM technology have been developing over the years, in research areas such as statistics, artificial intelligence, and machine learning. Today, these technologies are mature, and when coupled with relational database systems and a culture of data integration, they create a business environment that can capitalise on knowledge formerly buried within the systems.

DM tools take data and construct a representation of reality in the form of a model. The resulting model describes patterns and relationships present in the data. DM, as it relates to the discovery and analysis of patterns and regularities, can be related to two broad classes of tasks, which are profiling and predicting, which, in their turn, are related to the ideas of pattern identification. Typical prediction tasks are centred on the key questions of: Who, What, Where, When, Which gives rise to questions such as: Who is most likely to be delinquent in their future payments? What is the predicted average cost of acquiring new customers? Where, should a new store be built to optimise ROI? When is someone likely to stop being a customer? Profiling on the other hand is more concerned with what a particular group looks like, and is very much associated with the Why. It provides the capability to profile those, who are members of a given class, for example, those customers who provide the most ROI, or the most loyal customers, or those who are most likely to buy an upgrade on a product. From a process perspective, DM activities fall into three general categories, as illustrated in Figure 29.

- Discovery, the process of looking in a database to find hidden patterns without a predetermined idea or hypothesis about what the patterns may be.
- Predictive Modelling, the process of taking patterns discovered from the database and using them to predict the future.
- Forensic Analysis, the process of applying the extracted patterns to find anomalous or unusual data elements.

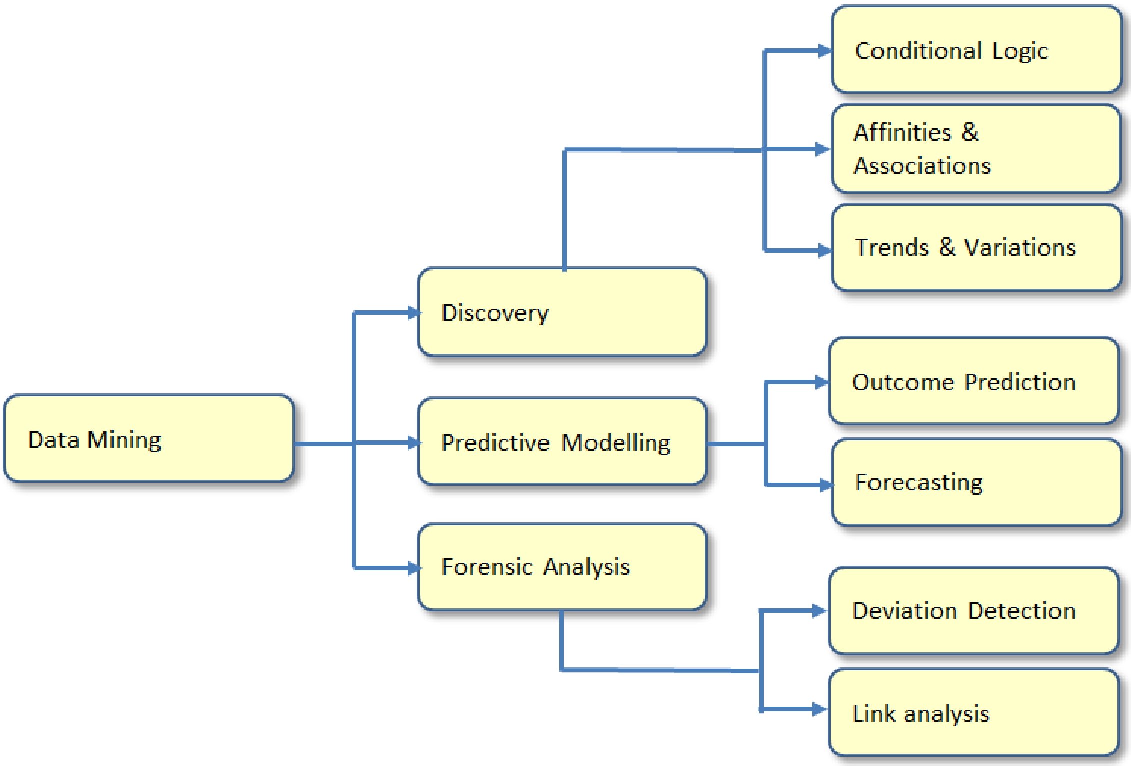


Figure 29: Data Mining Process Orientation. *Source: (Parsaye, 1997)*

Organisations are very interested in, and are constantly trying to find ways of predicting the behaviour of their customers, and data mining represents a methodology for doing this. Some of the methods that they use to do this are as follows: Through the use of store-branded credit cards and point-of-sale systems, retailers can keep detailed records of every shopping transaction. This enables them to better understand their various customer segments. Some retail applications include: performing basket analysis, which is also referred to as affinity analysis. Basket analysis reveals which items customers tend to purchase together. This knowledge can improve stocking, store layout strategies, and promotions. The examination of time-based patterns helps retailers make stocking decisions. If a customer purchases an item today, then, when are they likely to purchase a complementary item? Retailers can develop profiles of customers which illustrate certain patterns of behaviour, for example, those who purchase designer label clothing, or those who attend sales. This information can then be used to focus cost-effective promotions. When retailers add new outlets, they can improve sales planning and allocation by examining patterns in stores with similar demographic characteristics. Retailers can also use DM to determine the ideal layout for a specific store. Banks can utilise knowledge discovery for various applications, including the following: By identifying customer segments, card issuers can improve profitability with more effective acquisition and retention programmes, targeted product development, and customised pricing. Card issuers can take advantage of data mining technology to price their products so as to maximise profit and minimise loss of customers. Fraud is enormously costly, and by analysing past transactions that were later determined to be fraudulent, banks can identify patterns. DM helps banks predict each customer's lifetime value and to service each segment appropriately. Telecommunication companies around the world face escalating competition which is forcing them to aggressively market special pricing programmes aimed at retaining existing customers and attracting new ones. Knowledge discovery in telecommunications is enhanced by identifying customer segments with similar usage patterns which the companies can then develop to provide attractive pricing and feature promotions. Some customers repeatedly switch providers, or *"churn",* to take advantage of attractive incentives by competing companies. The companies can use DM to identify the characteristics of customers who are likely to remain loyal once they switch, thus enabling the companies to target their spending on customers who will produce the most profit.

4.4. Extract, Transform and Load

In order to build up a multi-dimensional DW, data needs to be extracted and brought to the BI environment. The ETL process is the end to end process of taking data from one system and loading it into another system. ETL primarily consists of mapping source and target schema, followed by defining and capturing the transformations between schema elements in ETL jobs, and running the jobs to actually move the data from the source system to the target system. The schema mapping step is usually a target driven activity as the target model identifies the data required to make the new system functional (Agrawal *et al*., 2008). Given the variety of source systems, possible connectivity is a key word here. After extraction, the data needs to be transformed. Transformation can mean a lot of different things, but it includes all activities to make the data fit the multi-dimensional model that makes up the data warehouse. Given the significant difference between ER models and multi-dimensional models, the transformations may become quite complex. Along with this, there is the extra work required to clean up and *"harmonise"* the data coming from different systems, this makes it quite understandable why some authors describe ETL work as 70 per cent of the IT side of a BI project. Usually a separate database or specific zone in the DW is reserved as storage space for intermediate results of the required transformations. This area is called often staging area or work area. After all the transformation work, the prepared data can be loaded into the multi-dimensional model. Although this step is not as complex as the transformation part, a lot of attention needs to be given to it, since data loaded to the DW has the possibility to be accessed by a broad range of end users. A specific aspect of the ETL work which has gained much attention during the last years is everything related to data quality. Data profiling is the activity of ascertaining the level of data quality one might expect to get from a specific source system prior to starting the ETL work. This analysis might be quite complex, so specific tools have been developed for this. However, the value of knowing any data deficiencies before engaging in an expensive BI programme is quite substantial.

Building a technically perfect BI solution with perfectly unusable data can be a very expensive mistake (Chaudhuri and Dayal, 1997), and since a DW is used for decision making, it is important that the integrity of the data that is contained within the warehouse is high. However, since large volumes of data from multiple sources are involved, there is a fairly high probability that the data contains errors and anomalies. Therefore, tools that help to detect data anomalies and correct them can have a high payoff. Some examples where data cleaning becomes necessary are: inconsistent field lengths, inconsistent descriptions, inconsistent value assignments, missing entries and violation of integrity constraints. Not surprisingly, optional fields in data entry forms are significant sources of inconsistent data. Data cleansing refers to specific activity of cleaning up data. There are three classes of data cleaning tools. Data migration tools allow simple transformation rules to be specified; e.g., *"replace the string gender by sex"*. Data scrubbing tools use domain-specific knowledge to do the scrubbing of data. They often exploit parsing and fuzzy matching techniques to accomplish cleaning from multiple sources. Some tools make it possible to specify the *"relative cleanliness"* of sources. Data auditing tools make it possible to discover rules and relationships by scanning data. Thus, such tools may be considered variants of DM tools. Specific tools are available where one can validate customer addresses against an external database of addresses so all address information in the DW is identical and verified. Similar methods of cleansing are available for product classification codes. After extracting, cleaning and transforming the data, it must be loaded into the warehouse, where additional pre-processing may still be required, which involves; checking integrity constraints; sorting; summarisation, aggregation and a range of other computations to build the derived tables stored in the warehouse; building indices and other access paths; and partitioning to multiple target storage areas. Typically, batch load utilities are used for this purpose. In addition to populating the warehouse, a load utility must also allow the system administrator to monitor status, to cancel, suspend and resume a load, and to restart after failure with no loss of data integrity. The load utilities for DWs have to deal with much larger data volumes than for operational databases. There is only a small time window (usually at night), when the warehouse can be taken offline to refresh it. Sequential loads can take a very long time, e.g., loading a terabyte of data may take weeks! Hence, pipelined and partitioned parallelism, are typically exploited. Doing a full load, has the advantage that it can be treated as a long batch transaction that, builds up a new database. While it is in progress, the current database can still support queries; when the load transaction commits, the current database is replaced with the new one. Using periodic checkpoints ensures that if a failure occurs during the load, the process can restart from the last checkpoint.

4.5. OLAP

OLAP is a series of protocols that are used mainly for business reporting. Using OLAP, businesses have the ability analyse data in a number of different ways, including budgeting, planning, simulation, DW reporting, and trend analysis. OLAP has been defined as *"the name given to the dynamic enterprise analysis required to create, manipulate, animate and synthesize information from exegetical, contemplative and formulaic data analysis models. This includes the ability to discern new or unanticipated relationships between variables, the ability to identify the parameters necessary to handle large amounts of data, to create an unlimited number of dimensions, and to specify cross-dimensional conditions and expressions"* (Codd *et al*., 1993). During the 1980s there was a lot of activity in the area of Statistical Databases, focusing mostly on socio-economic type applications, such as census data, national production, and consumption patterns. In the 1990s OLAP was introduced for the analysis of transaction based business data, such as retail stores transactions (Shoshani, 1997). A key feature of OLAP is its ability to make multidimensional calculations, allowing for an expeditious and wide array of possibilities. In general, the bigger the business, the bigger its business reporting needs. Multidimensional calculations enable a large business to complete in seconds, what otherwise would have taken a considerably longer time to accomplish. One of the main benefits to be derived from OLAP is the consistency of the calculations it performs. No matter how fast data is processed through OLAP software or servers, the reporting that results, is presented in a consistent presentation, so executives always know what to look for and how to access it. This is especially helpful when comparing information from previous reports to information contained in new ones and projected future ones. *"What if"* scenarios represent some of the more popular uses of OLAP software, and these can be facilitated relatively easily by multidimensional processing. Another benefit of multidimensional data presentation is; that it allows a manager to pull down data from an OLAP database in broad or specific terms. In other words, reporting can be as simple as comparing a few lines of data in one column of a spread-sheet, or as complex as comparing all aspects of significant amounts of data. Also, multidimensional presentation can create an understanding of relationships not previously realised. This can all be achieved within very short time frames. OLAP applications require viewing the data from many different business dimensions. The Data cube according to (Gray *et al.*, 1997), is a multidimensional view of a database, where a critical value, e.g., sales, is organised by several dimensions. For example, sales of a particular consumer product organised by model, colour, day of sale, along with other attributes. The metric of interest is called the measure attribute, which in Figure 30, is sales.

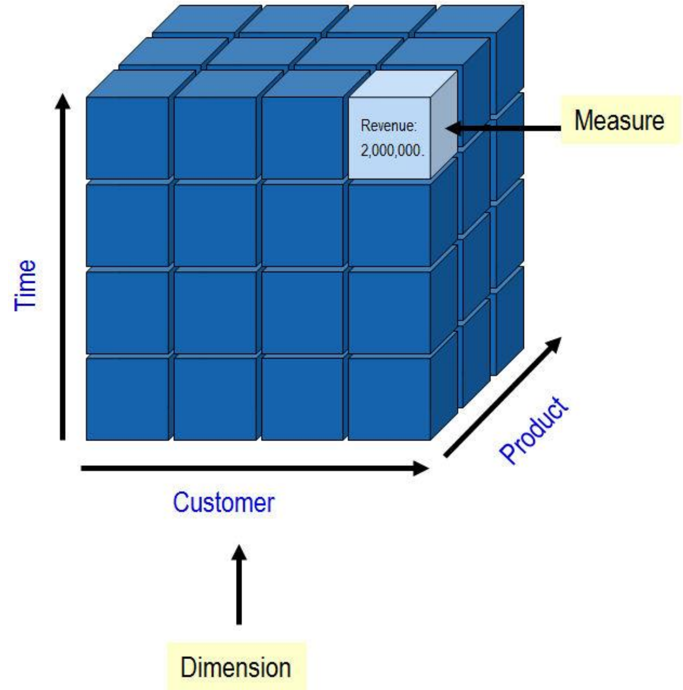


Figure 30: A Three dimensional Data Cube. *Source: (Hamel and Hall, 2000)*

It is generally accepted that OLAP systems need to present such a multidimensional view of the data to users. Each cell of the data cube corresponds to a unique set of values for the different dimensions and contains the value of the measure for this set of values (Gupta *et al.*, 1997). Within a typical relational database, queries are posed against a set of normalised database tables in order to retrieve instances that fulfil certain constraints on their attribute values (Date, 2003). The normalised tables are usually associated with each other via primary and foreign keys. For example, a normalised database of a distributor with multiple outlets might look something like the database as illustrated in Figure 31 below. Here, PK and FK indicate the primary and foreign relational keys, respectively.

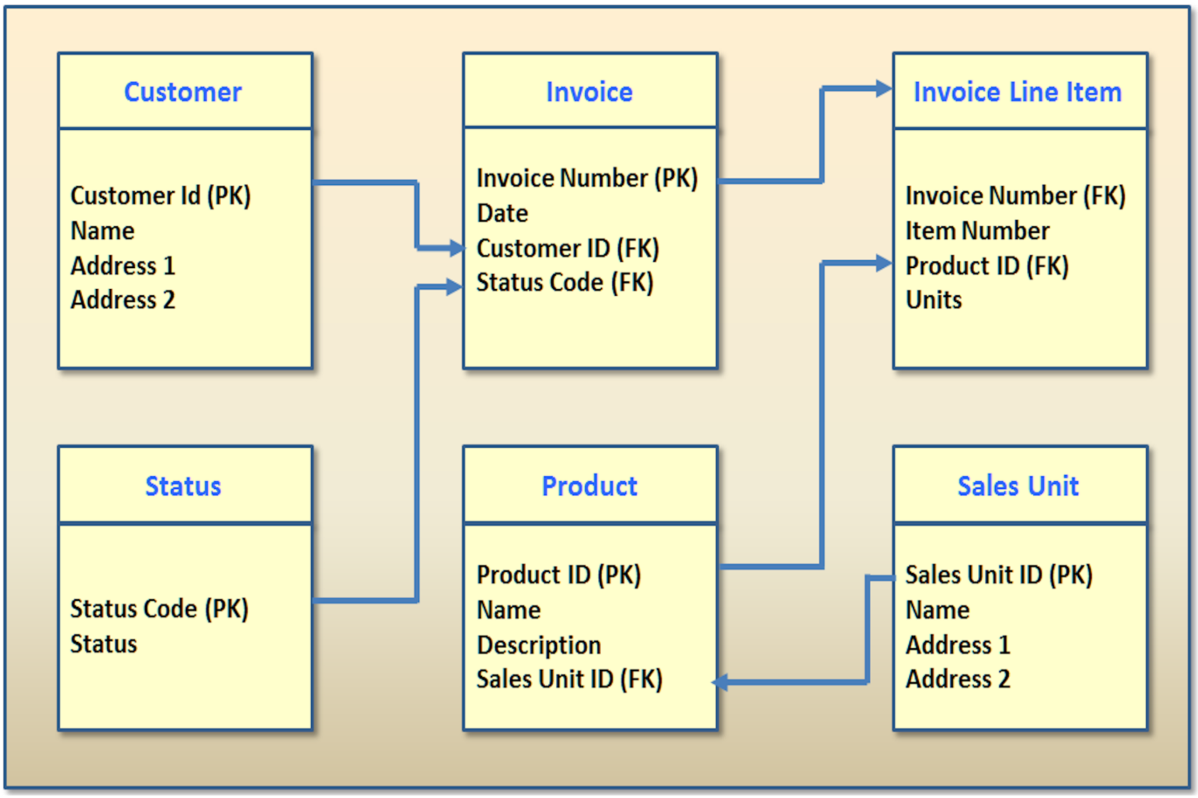


Figure 31: A Normalised Database Schema. *Source: (Hamel and Hall, 2000)*

Although it is possible to extract information with standard SQL queries from this type of database, the normalised nature of the database makes the formulation of the appropriate SQL queries rather difficult. Furthermore, the query process is likely to be slow due to the fact that it must perform complex joins and multiple scans of entire database tables in order to compute the desired aggregates. By rearranging the database tables in a slightly different manner and using a process called pre-aggregation or computing cubes, the above questions can be answered with much less computational power enabling a real time analysis of aggregate attribute values (Craig *et al*., 1999, Kimball, 1996, Scalzo, 2003). In order to enable OLAP, the database tables are usually arranged into a star schema where the inner-most table is called the fact table and the outer tables are called dimension tables. Figure 32 illustrates a star schema representation of the distributor which has been organised along the main dimensions of the store business: customers, sales units, products, and time (Hamel and Hall, 2000).

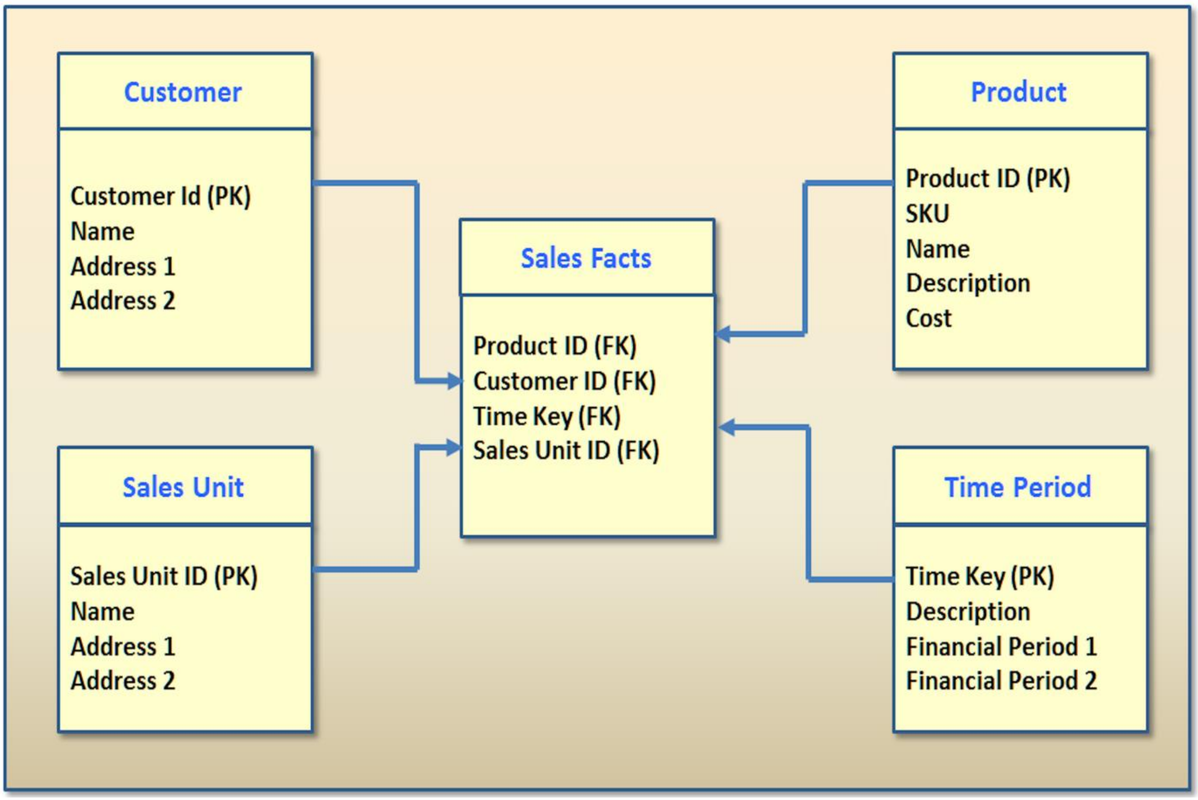


Figure 32: Star Schema for a Database. *Source: (Hamel and Hall, 2000)*

The fact table relates the dimensions to each other, and specifies the measures which are to be aggregated. Here the measures are *"receipts total", "sales tax",* and *"shipping charge"*. In the cube building process, the measures are aggregated along the smallest unit in each dimension giving rise to small pre-aggregated segments in a cube. Data cubes can be seen as a compact representation of pre-computed query results. Essentially, each segment in a data cube represents a pre-computed query result to a particular query within a given star schema. The efficiency of cube querying allows the user to interactively move from one segment in the cube to another enabling the inspection of query results in real time. Cube querying also allows the user to group and ungroup segments, as well as project segments onto given dimensions. This corresponds to such OLAP operations as roll-ups, drill-downs, and slice-and-dice, respectively (Gray *et al*., 1997).

4.6. CRM Marketing

Research findings in the traditional marketing literature conclude that greater customer loyalty leads to higher customer profitability (Clark, 1997, Hallowell, 1996, Reichheld and Teal, 2001, Storbacka *et al*., 1993). Given this belief in the economic advantage of customer loyalty, there is agreement in the need to investigate the online factors underlying customer relationship building (Grönroos, 1993, Gilbert, 1996, Clark, 1997). In a review conducted by (Porter, 2001a), of the impact of the Internet on industry structure, he found cases of companies focusing on price instead of continuing with their existing strategies of features, quality and service. This is understandable, since the Internet has been propagated as a near-perfect market, which offers an unprecedented transparency beyond the capabilities of conventional media. This has proved to be a poor decision for many organisations leading Porter to conclude that *"the Internet per se will rarely be a competitive advantage alone and that Internet Technology provides better opportunities for companies to establish distinctive strategy, positioning and gaining such a competitive advantage will not require a radically new approach to business"* (Lee-Kelley *et al*., 2003). The author agrees that the Internet within itself, does not offer a competitive advantage however, it does offer a platform to allow organisations to choose how they interact with their customers. The Web allows companies to build better relationships with customers than has been previously possible in the offline world. By combining the abilities to respond directly to customer requests and to provide the customer with a highly interactive, customised experience, companies have a greater ability today to establish, nurture, and sustain long-term customer relationships than ever before. These online capabilities complement personal interactions provided through salespeople, customer service representatives, and call centres. At the same time, companies can choose to exploit the low cost of Web customer service to reduce their service costs and offer lower-quality service by permitting only electronic contact. The flexibility of Web-based interactions thus permits firms to choose to whom they wish to offer services and at what quality level (Winer, 2001). The need to better understand customer behaviour, and the requirement of many managers to focus on those customers who can deliver long-term profits, has changed how marketers view the world. Traditionally, marketers have been trained to acquire customers, either new ones who have not bought the product before or those who are currently competitor's customers. This has required large amounts of mass advertising and price-oriented promotions to customers and channel members. In today's environment, the focus has shifted from one of customer acquisition to customer retention.

This requires a different mind-set and a different and new set of tools. It has been observed that the focus of many organisations has been on customer acquisition rather than retention. It has been reported in some studies that, on average, it costs more for a company to attract a new customer than it does to implement a retention strategy to retain an existing customer. (Reichheld and Schefter, 2000), in their study of the Internet clothing market, found that customer acquisition cost is 20 per cent to 40 per cent greater than acquiring a new customer in the traditional retailing marketplace. This leads to higher losses in the early stages of the relationship, but if the relationship is maintained over a one or two year time frame, then customers are likely to spend twice as much as they did in their first six months spending. In an earlier study, (Reichheld and Sasser Jr, 1990), found that existing customers are not only less price sensitive; they are more economical to maintain than new customers. Therefore, if this additional propensity to spend can be directed towards an extended range of products rather than mere repeat purchases of the original product, then the possibility of increasing profitability is high, and Reichheld was also able to demonstrate a dramatic increase in profits from small increases in customer retention rates. His studies showed that as little as a 5 per cent increase in retention had impacts as high as 95 per cent on the net present value delivered by customers.

Other studies done by consultants such as McKinsey have shown that repeat customers generate over twice as much gross income as new customers. The considerable improvements in technology and innovation in CRM-related products have made it much easier to deliver on the promise of greater profitability from reduced customer turnover, and (Yim and Kannan, 1999), defines *"hard-core"* loyalty as consisting exclusively of repeat purchase behaviour. At the same time, the study by (Bentley1999), has linked customer loyalty directly to profitability by confirming the suggestion of (Reichheld and Sasser Jr, 1990), that loyal customers are less sensitive to price changes and are more susceptible to being charged premium prices. It is postulated by (Gilbert, 1996), that Relationship Management (RM) schemes can reduce the long-term costs of attracting new customers by increasing the length of time that they maintain the relationship with a company. The term CRM emerged in the IT vendor and practitioner communities in the mid-1990s. It is often used to describe technology-based customer solutions, such as Sales Force Automation (SFA). In the academic community, the terms *"Relationship Marketing"* and CRM are often used interchangeably (Parvatiyar and Sheth, 2001). However, CRM is more commonly used in the context of technology solutions and has been described as *"information-enabled relationship* *marketing"* (Ryals and Payne, 2001). It has been suggested by (Zablah *et al*., 2003), that CRM is *"a philosophically-related offspring to relationship marketing which is for the most part neglected in the literature",* and they conclude that *"further exploration of CRM and its related phenomena is not only warranted but also desperately needed"* (Payne and Frow, 2005). One of the problems, that many organisations face when deciding to adopt CRM, stems from the great deal of confusion about what CRM really means, or how to define it. The importance of how CRM is defined is not merely semantic. It affects the way an entire organisation accepts and practices CRM. From a strategic viewpoint, CRM is not simply an IT solution that is used to acquire and grow a customer base; it also involves a deep understanding of the strategic vision, and a corporate understanding of the nature of customer value in a multichannel environment. This requires the utilisation of the appropriate information management and CRM applications, using high-quality operations, which provide fulfilment of the required services. It is suggested by (Payne and Frow, 2005), that CRM can be defined from three different perspectives: 1: narrowly and tactically as a particular technology solution, 2: wide-ranging technology, and 3: customer centric. These perspectives can be portrayed as part of the CRM continuum, which is illustrated in Figure 33.

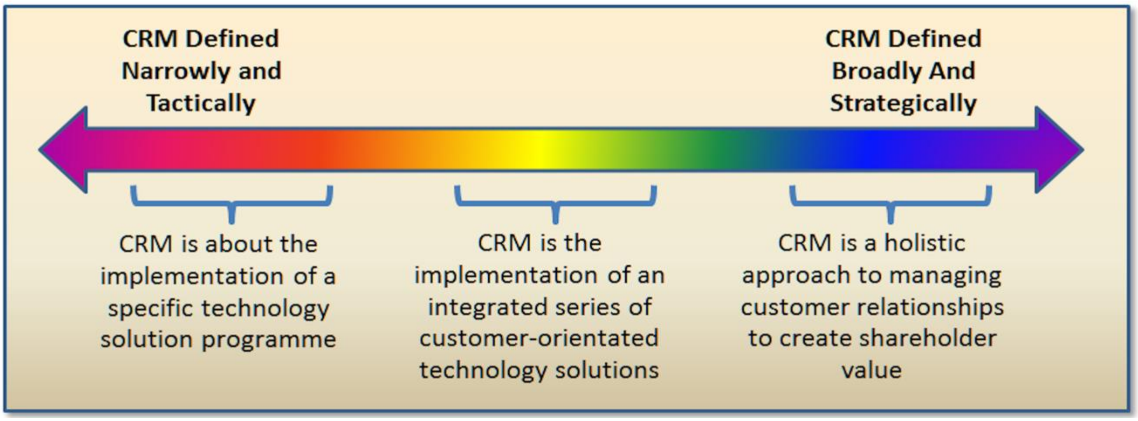


Figure 33: The CRM Continuum. *Source: (Payne and Frow, 2005)*

From an examination of the CRM literature, (Payne and Frow, 2005), synthesised various aspects of the definitions available, which they then developed into the following definition:

"CRM is a strategic approach that is concerned with creating improved shareholder value through the development of appropriate relationships with key customers and customer segments. CRM unites the potential of relationship marketing strategies and IT to create profitable, long-term relationships with customers and other key stakeholders. CRM provides

enhanced opportunities to use data and information to both understand customers and to create value with them. This requires a cross-functional integration of processes, people, operations, and marketing capabilities that is enabled through information, technology, and applications." According to (Park and Kim, 2003), customer information can be classified into three types:

- Information of the customer.
- Information for the customer.
- Information by the customer.

First, *"of-the-customer"* information includes personal and transaction data about a customer. It is the type of information most widely collected for CRM implementations. Firms obtain the personal data, which allows them to understand the customer's sales volumes, profitability, purchasing patterns, frequency, and preferences, along with other requirements. For example, banks and credit card firms keep enormous amount of *"of-the-customer"* information in their database systems related to, opening, maintaining, and billing customer accounts, and also to identify the most, or least profitable customers. Database marketing, also called target marketing, is based on the strategic use of *"of-the-customer"* information. Second, product, service and organisational information that are perceived useful by customers is referred to as *"for-the-customer"* information. This type of information is presented through diverse communication media so that customers acquire and process it to make more informed decisions. Firms can provide such information by direct mail, automatic response system (ARS), or Internet home pages. The third type is *"by-the-customer"* information. This is the non-transactional customer feedback information that includes customer complaints, propositions, claims, and a range of other details and facts. Information of this type must be included in the expanded customer data profile because such information is what makes customer interactions powerful (Wells *et al*., 1999). Since it contains customers' direct complaints, needs and suggestions, this type of information can be applied to develop new products and services or improve critical business processes.

Figure 34 illustrates the integrated customer relationship management framework based on customer information types along with relationship evolution stages. At the relationship initiation stage, firms identify customers by collecting and recording *"of-the-customer"* information. Registering customers into the firm's membership or the use of bonus point programmes is a typical method used for customer identification and retention.

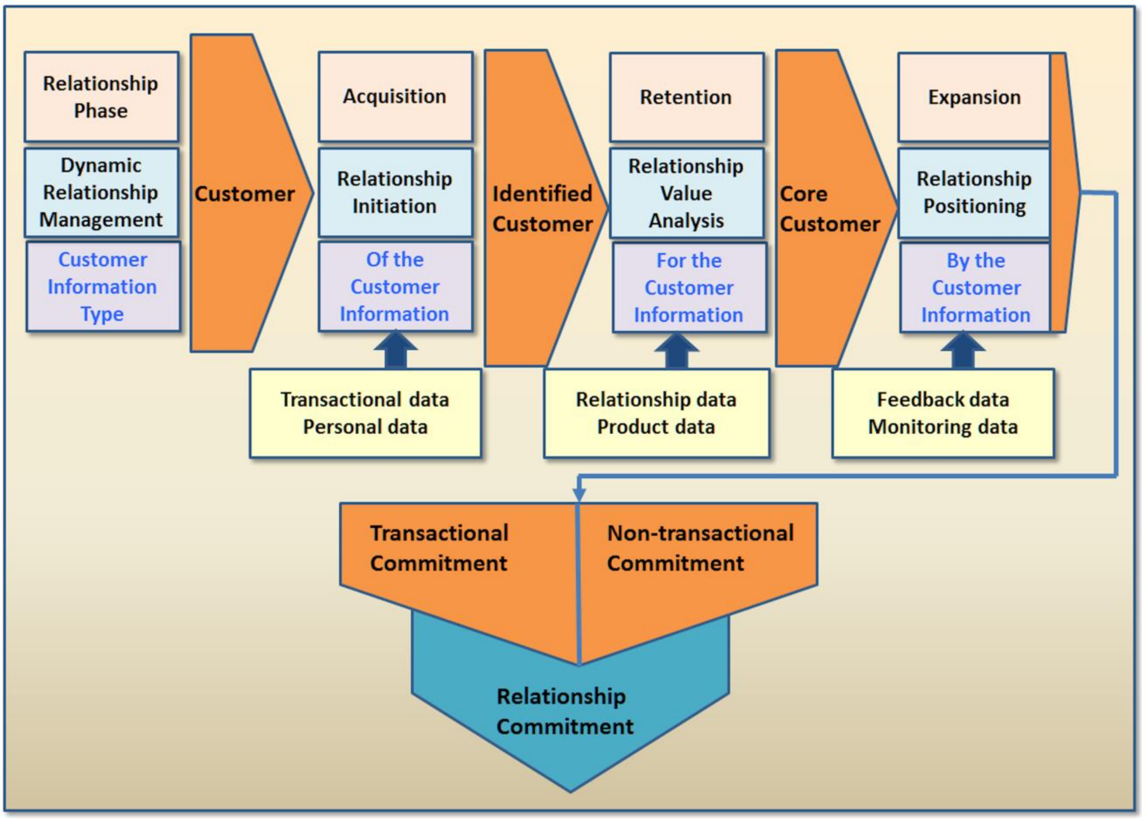


Figure 34: A Framework of Customer Relationship Management. *Source: (Park and Kim, 2003)*

For the identified customers, firms can provide various *"for-the-customer"* type information, for example, newsletters, special promotion notices, bonus point status, order status, as well as a customised service. Some of the identified customers, after a certain period of a satisfactory relationship experience, eventually evolve into core customers who satisfy one or more of the criteria required in order to be considered a core customer. As identified customers evolve into core customers, the firm enters the *"expansion phase"* in its CRM. In this phase, core customers actively participate in the two-way interactions with the firm and expand the firm's customer base by word-of-mouth marketing. Feedback or suggestions from these core customers, through the use of *"by-the-customer"* information, may prove to be vital to allow the firm to introduce new products, improve business processes, and satisfy customer needs. The boundary between the firm and its customers becomes transparent in this phase. The objective of a good CRM programme should be to deliver a higher level of customer satisfaction than competing organisations deliver. Managers today realise that customers match realisations and expectations of product performance, and that it is critical for them to deliver such performance at higher and higher levels as expectations increase due to competition, marketing communications, and changing customer needs. In addition, research has shown that there is a strong, positive relationship between customer satisfaction and profits. Thus, managers must constantly measure satisfaction levels and develop programmes that help to deliver performance beyond targeted customer expectations (Winer, 2001).

4.7. Geographic Information Systems

A Geographic Information System (GIS) is designed to capture, store, display, communicate, transform, analyse, and archive geo-referenced information, that is, information tied to specific locations on the Earth's surface. GIS enhance and to some extent replace the traditional role played by maps, but are also capable of handling information in the form of satellite images of the Earth's surface, as well as information from surveys and administrative records that have been geo-referenced. They are increasingly used in the social sciences to support research based on cross sectional data, or studies for which geographic location and context are important and useful (Goodchild, 2006). One of the emerging needs in knowledge discovery is the requirement to take spatial data into consideration. It is nowadays required by more and more users to perform fast spatio-temporal analysis, interactively exploring the data without being slowed down by the intricacies of a SQL-type query language and cryptic data structures, and easily synchronizing among different views of the data exploration landscape. More particularly, users require the possibility to display data on maps, to allow them to compare maps of different terrain or different times, to enable research into these maps to get more details, or conversely to roll up data to visualize maps displaying a range of global information, and to display these maps along with tables and statistical charts to get more insights into their datasets. This can be achieved by combining the capabilities of GIS with those of OLAP systems, paving the way to a new technology called *"SOLAP"* (Spatial OLAP) (Bédard *et al*., 2006). SOLAP can be looked upon as a visual platform built especially to support rapid and easy spatio-temporal analysis and exploration of data following a multi-dimensional approach comprised of aggregation levels available in cartographic displays as well as in tabular and diagram displays (Bédard *et al*., 1997). SOLAPs are designed to be client applications sitting on top of a multi-scale spatial data warehouse (Bédard *et al*., 2001). However, the non-expert can visualise them as a new type of user interface for multi-scale GIS applications and Web mapping (Rivest *et al*., 2001). Figure 35 illustrates the domain of typical SOLAP applications compared to the domain of typical GIS applications.

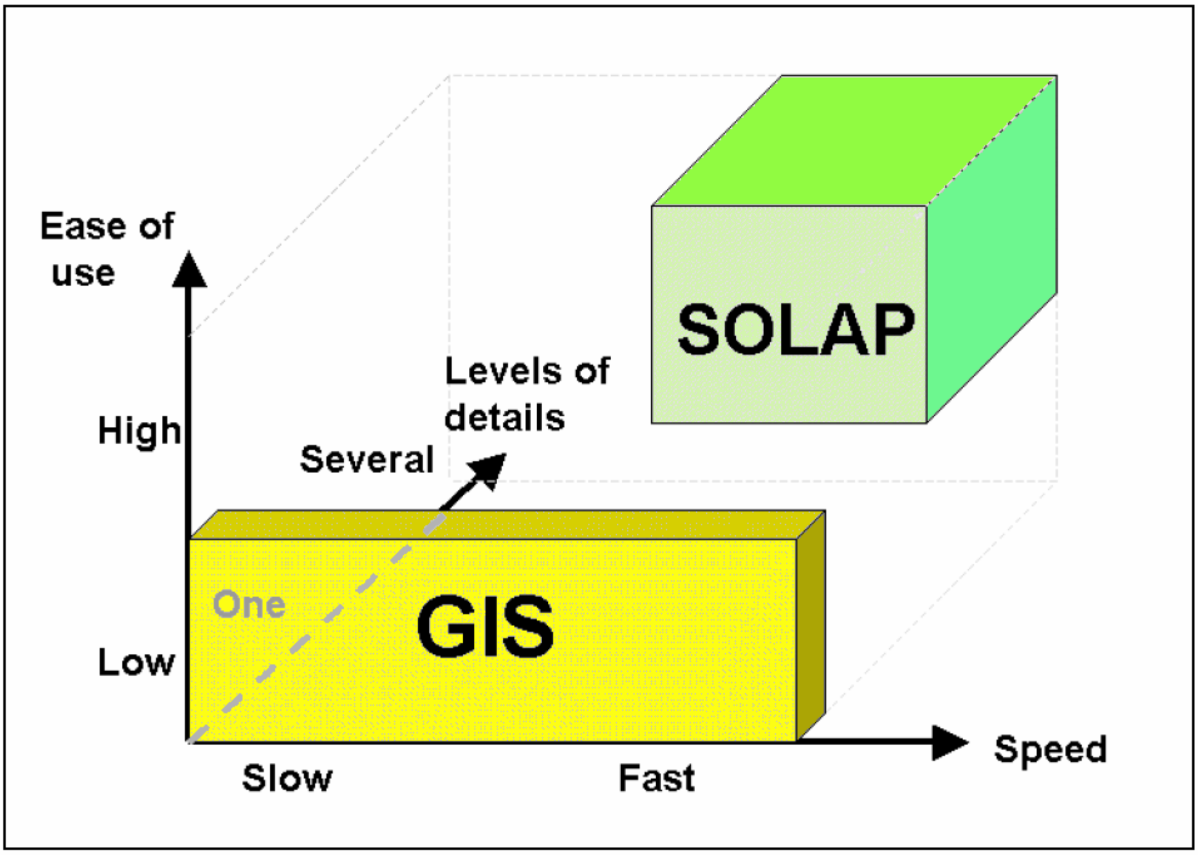


Figure 35: Requirement for Spatial Decision-Support. *Source: (Rivest et al., 2001)*

The interface of a SOLAP tool is composed of two main parts: the visualisation space and the navigation panel. The visualisation space allows the user to see the desired information in the form of one to many maps, statistical diagrams or tables with the possibility to change the displays in order to see the information in the most meaningful way, along with the possibility to synchronise all the displays. All the displays are dynamic in the sense that the user can use different operators to *"navigate"* inside the dataset through the displayed elements. In the context of information exploration, maps and graphics do more than make data visible; they are active instruments in the end-users thinking process (MacEachren and Kraak, 2001). All the possible views, displayed as maps, diagrams or tables, do not have to be prepared in advance, but are dynamically managed by the SOLAP server. The navigation panel allows the user to select one or more attributes of each dimension, and also the measures, to be viewed in the visualisation space. All the possible combinations of dimension members and measures are available, and are presented to the user through lists or tree views. The user clicks on the elements in the lists and the displays are automatically updated to reflect the new selection.

4.8. BI Reporting

An essential component that contributes to the success of many organisations is their ability to take advantage of all the available information distributed across all the various functions. This challenge becomes more difficult as the volume of information increases, both internally and externally. This problem is further compounded by the fact that many organisations are becoming increasingly "*knowledge-centric,*" and therefore a larger number of employees need access to a greater variety of information to be effective. As data sources proliferate it is becoming increasingly difficult for companies to produce consistent and timely operational reports. Many companies are implementing scorecards and dashboards as key components of their BI initiatives. These tools visually summarise large amounts of data related to organisational performance. Two technologies have been central in improving the quantitative and qualitative value of the knowledge available to decision makers, which are; Business Intelligence and Knowledge Management. BI has applied the functionality, scalability, and reliability of modern database management systems to build ever-larger data warehouses, and to utilise data mining techniques to extract business advantage from the vast amount of available enterprise data.

Knowledge Management technologies, while less mature than BI technologies, are now capable of combining today's content management systems and the Web with vastly improved searching and text mining capabilities to derive more value from the explosion of contextual information (Cody *et al.*, 2002). With the aid of dashboards which have been designed from a user perspective, a user can, in a single or a few screens, very easily, see how actual performance compares to goals, benchmarks, and previous performance, which is illustrated in Figure 36. The adage *"that which gets watched, gets done"* exemplifies the value of scorecards and dashboards (Watson and Schneider, 2001). The objective of a BI solution is to offer a tool where end users can easily access data for analytical purposes. Unfortunately databases have a reputation for being somewhat user-unfriendly. To make data access easier for end users most vendors of reporting solutions have provided the possibility to create a layer between the database and the reporting tool. In this layer the database fields can be translated into *"objects"*, each having a clear business definition. These objects can be dragged and dropped onto a report, making report creation a much simpler task. The semantic layer and the reports produced on top of the DW represent only the tip of the iceberg for a person within the IT department, but for most of the end users they are the only visible part of the BI solution. IT professionals tend to give less attention to the reporting part of the BI application, than to the big IT work that goes into the construction of the DW. It is in this part of the architecture that, that it is necessary to make a distinction between how IT persons view the BI environment and how end users view the BI environment. For end users the availability of reports, access to the reporting tools, correctness of titles and descriptions on the reports is crucial, and lack of attention on this side may result in a serious failure of the BI project, even with a correctly modelled data warehouse, perfect architecture and good quality data.

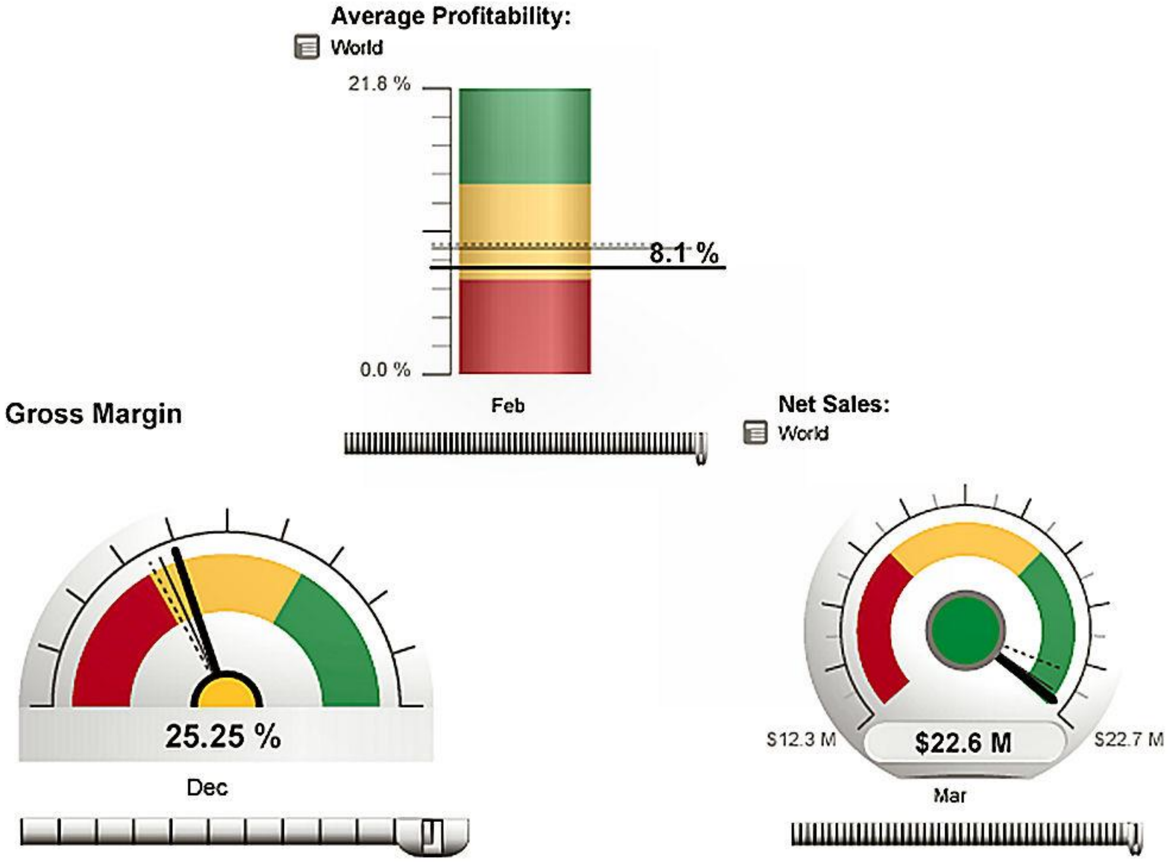


Figure 36: Business Intelligence Dashboard. *Source: (Few and Online, 2006)*

The richness of reports that can be provided to end users is sometimes outside of the comprehension of typical IT persons, but also outside of the imagination of the business community. IT people often know too little of the business to format a report into the most readable, easiest understandable graph, while business users have too few insights into the technical possibilities of the platform, and have been forced to think within the limits of the same graphs and tables they have always worked with. A good deal of attention needs to be paid to the collaboration between IT and business in order to build a good set of reports that maximises the return on investment of the BI project. Usually the reports are structured in the following manner:

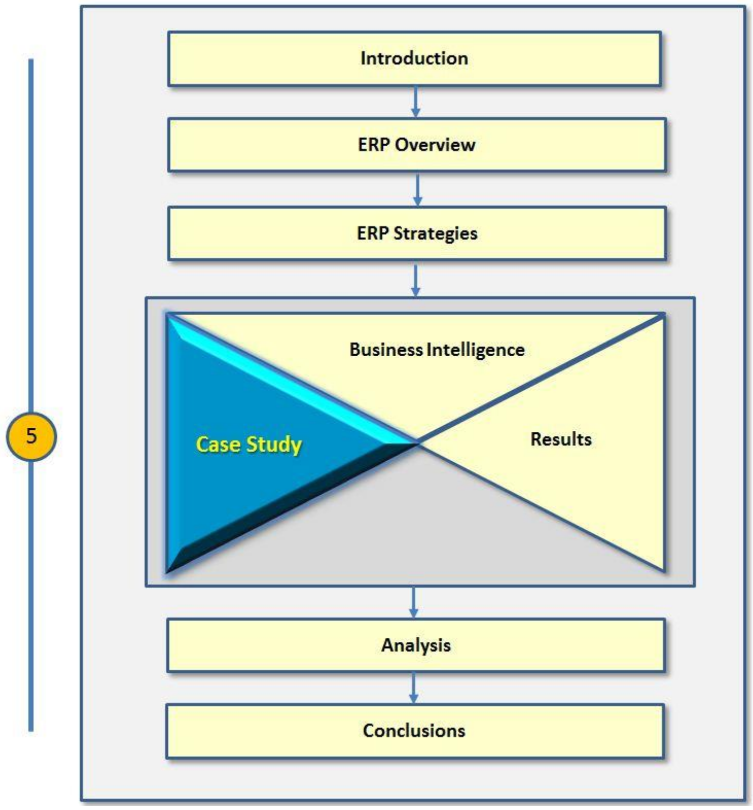
- Standard reports: Fixed reports scheduled point in time or at user request without any further required input.
- Parameter reports: Reports of fixed lay-out, available at user request, requiring input of some parameters when the user launches the report.
- Ad-hoc analysis: Report created by the user on the spot, either starting from an existing standard or parameter report or from scratch show data from the data warehouse and allow input of data with write-back to the data warehouse.
- Dashboards: Highly aggregated reports, containing a multitude of KPI’s and thus showing an overview of how the company or a department is doing. Mostly dashboard reports combine actual figures with target figures (as well as figures of previous year or month for comparison).
- Data quality reports: To follow up the evolution of the quality of the information in your data warehouse usually the data quality steward requires some specific data quality reports. Also data profiling tools and data cleansing tools may provide their own reports that fall into this category.
- Data mining reports: As output of data mining exercises, before feeding the results back to the data warehouse usually there are several outputs to be interpreted. These reports, aimed at the analyst working with data mining, are usually part of the data mining tool.
- IT technical reports: A series of technical reports to follow up; load performance, query performance, number of users, and data volumes, which are necessary for the good functioning of the BI solution.
- Meta data reports: In order to give end users and system analysts a good insight into what data is available and how it has been transformed to match the company’s business definitions, an overview of the metadata is very interesting.

It is important to realise for each functional set of reports who, will be the main users. A good allocation of report ownership, and clear rules for version and release management will help to keep control of the many reports that will be created.

Chapter Five

Case Study

"Make no little plans. They have no magic to stir men's blood and probably will never be realised. Make big plans; aim high in hope and work, Think big." - Daniel Burnham



The previous chapters have described the nature of ERP and BI. Within this chapter, a case study demonstrates how many of the issues, surrounding both of these technology platforms are confronted and resolved within an organisational context. A brief description of the organisation, that the case study is based upon is provided, this is then followed by a description of the environment in which the organisation operates, and some of the challenges that it faced, from both an internal and external perspective, which led the organisation to undertake the radical transformation with regard to both ERP and BI. It demonstrates how this transformation was accomplished utilising a number of strategic management tools, in particular the SPACE Matrix which resulted in the organisation developing a number of significant strategic advantages. The case study is based upon a retail outlet chain PDV[1] which was founded in Belgium in the early 1900s and has approximately 3,000 stores employing nearly 150,000 people. Store formats are primarily general outlets, which represent about 90% of the sales network. Sales amount to €20 billion per year with a net income approaching €360 million. The groups operations are primarily centred in the USA and Belgium. PDV like many other organisations within this market segment had started out as a traditional bricks and mortar retail outlet chain. However, a number of years ago, PDV had become aware that sales were beginning to flatten out, and they were looking for new growth opportunities within the marketplace. Revenue growth is required in order to, first generate, and then sustain profits, and it represents the financial fuel of most organisations. Lack of growth, can have quite a number of undesirable effects, which include; products becoming uncompetitive, which in turn, can lead a business to become vulnerable to a takeover, or even failure. At that point in time, the IT infrastructure within the organisation was rather basic, consisting mainly of ad-hoc programmes and procedures which had been developed internally. The approach adopted by PDV to embrace the new technology, was a two phase one. First, an ERP solution was implemented and this was then followed by a BI initiative.

Over recent years, PDV realised that they were facing a number of challenges, which included:

- ❖ The growth of intensifying competition.
- ❖ Changes in the world of business and the threats and opportunities of globalisation.
- ❖ The increasing need for the organisation to become more customer-focused.
- ❖ The need to improve quality in order to provide cost-effective, flexible, reliable and timely products and services to its customers.

Making it a reality however, required establishing an integrative IT infrastructure that would enable the sharing of timely and reliable information across business processes, and the development of consistent standards as a means of reconciling various infrastructure

[1] PDV is a fictitious name of a company based on a case study within a large, online retailer.

components to provide shared IT services (Kayworth *et al*., 1997, Mullin, 1997). During the time that PVD had been in existence, a number of its procedures and functions had become outmoded, and there were aspects of its supply chain operations, which needed to be more tightly integrated within the organisation. Since the early years of its establishment, some of the company's major operations, such as production, sales, shipment, and inventory, had been supported by one application system, which had been written in a third-generation language, which was running on a fairly antiquated operating system, which was operating in tandem with a number of loosely coupled departmental and application-specific piecemeal systems. Due to a number of different alterations that had been made to these systems over time, a number of issues had come to the fore, which resulted in problems such as complex code, data redundancies and poor documentation, and therefore, the cost of maintaining the system began to rise sharply. PDV began the process of migrating some of its application systems into an Oracle database environment, which it then expanded in order to handle more complex business functionalities. However, this process resulted in little flexibility within the internal architecture of the system. Management understood that the key to achieving the change that they desired would be to revamp the current outdated IT infrastructure and migrate to a new, more flexible applications system that would result in a more effective supply-chain structure, which would be more responsive to customers' needs. The standardisation of the IT infrastructure became an issue which took on considerable importance, at both the board and executive level. The decision was therefore, taken to implement an ERP solution within the organisation with a time frame to completion of twelve months from commencement of the project.

5.1. Methodology

With respect to the process of ERP implementation (Kettinger *et al*., 1997), have proposed a six stage process, which was adopted by PDV and which involves a sequence of process steps, which are illustrated in Figure 37. The first step in the implementation of the ERP programme was to create a cross-functional team from across a range of disciplines within the organisation, which included representatives from: Human Resources, Quality Assurance, Marketing, and Sales, and a number of other key departments. The success of technological innovations has often been linked to the presence of a champion, who performs the crucial functions of transformational leadership, facilitation, and marketing the project to the users (Somers and Nelson, 2001). Top management commitment is critical for the success of the whole ERP implementation process (Gable and Stewart, 1999, Stratman and Roth, 1999). Change requires a strategic vision to ensure its long-term success (Aladwani, 1999). In a survey conducted by (Zairi and Sinclair, 1995), leadership was ranked the number one facilitator of large transformation efforts, such as the one introduced by an ERP system.

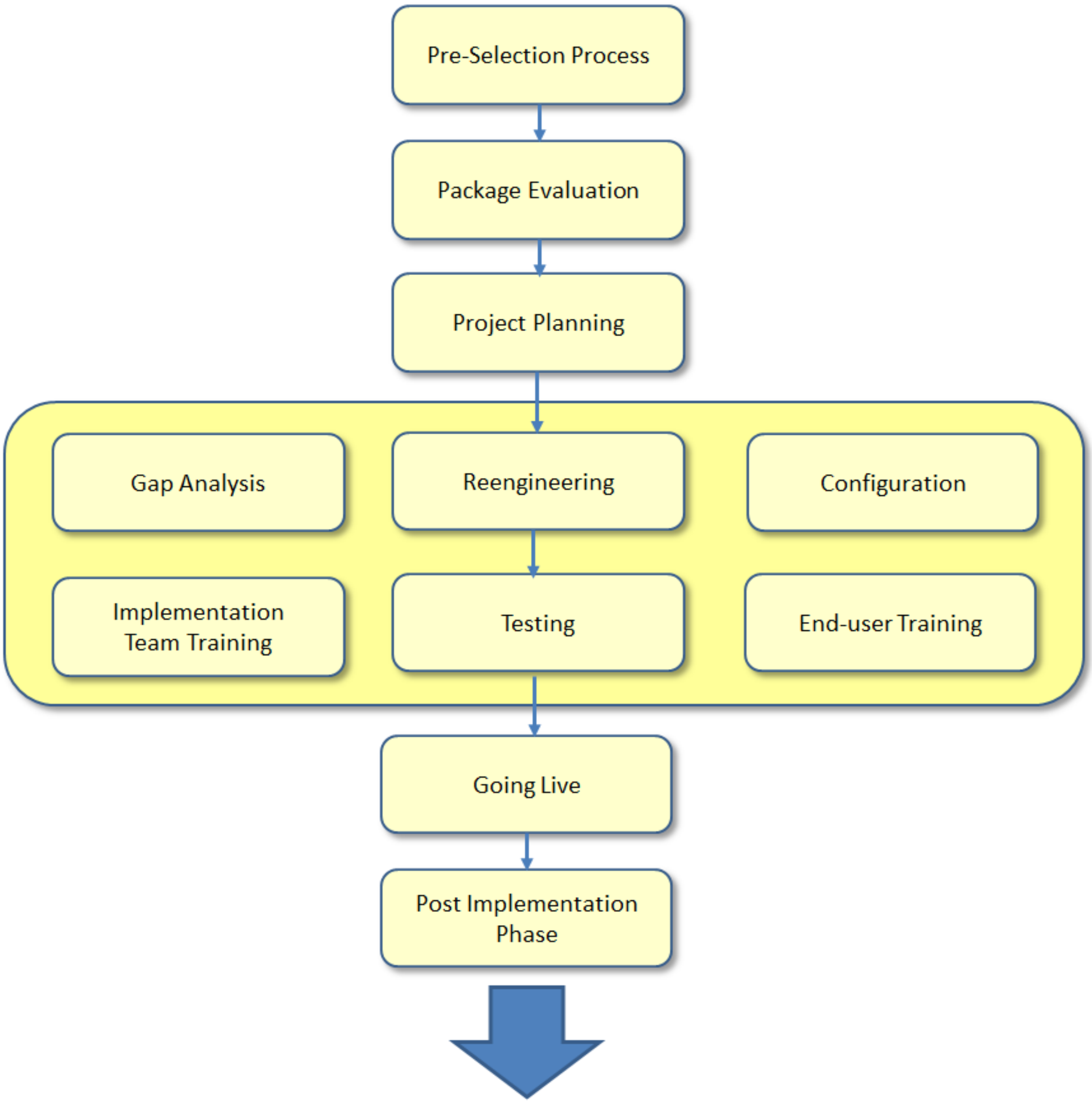


Figure 37: ERP Six Stage Process. *Source: (Kettinger et al., 1997)*

ERP implementation can only be accomplished when senior management within the organisation is totally committed to the initiative. Management commitment and support is a key strategy that will secure the necessary conditions for successfully introducing the change brought by ERP into the organisation. Usually, the *"Champion"* will be somebody at senior management level, this ensures that this person has the authority to make any required organisational changes happen (McKersie and Walton, 1991). One obvious place to look for someone to fulfil this role, within this context, is with the Chief Technology Officer (CTO), or else the Chief Information Officer (CIO) or VP in charge of IT (Willcocks and Sykes, 2000). This was no less the case in this instance, and the CTO was nominated as the programme champion, which lent the programme a substantial amount of prestige within the organisation. The importance of team competence has been well recognised within the literature, (Argyris and Schön, 1978, McGrath, 1984, Senge, 1993, Katzenbach and Smith, 1993). To this end the initial team that was put together, consisted of fifteen representatives across all the key functional areas within the organisation. Three of these were directly connected with the IT department, and therefore, they had direct experience with the requirements of an ERP system. Although, other members of the team did not possess this in depth IT knowledge, their experience across other functional areas within the organisation was invaluable in guiding the overall ERP programme. However, it was necessary to conduct quite a number of briefing sessions with the overall group, in order to educate team members on the background to ERP projects, the key challenges they would face as a project management team and the communication channels that would be required, in order to make meaningful decisions. Team members were therefore, able to gain an awareness of the extent of the changes that were about to take place and for which they would have to take responsibility. Top management were closely involved in, and were kept constantly appraised of all the key developments within the programme. Top management buy-in must be seen to be taking place (Ryals and Knox, 2001).

5.2. Vendor Evaluation

One of the first actions undertaken by the ERP team was to assess the current operational situation, and then develop a complete solution package based upon future requirements. Due to the extent of the programme envisaged, one of the many proposals put forward at the embryonic stage, was to embark on a possible BPR initiative. PDV having experienced very positive results with previous implementations involving BPR decided to give approval to this proposal. Thus, a decision was with made to implement a new BI system in conjunction with a reengineering effort. PDV reviewed the current systems and operations and identified the major problems to be tackled in the reengineering initiative. As changing the IT infrastructure was seen as a key determinant of the amount and scope of the efforts needed to carry out the entire reengineering initiative, a particular focus was initially placed on assessing the current IT infrastructure, as a number of shortcomings dad been identified within it. Resulting from the assessment exercise, two alternative IT infrastructure sourcing approaches to improve the company's operations were proposed. The first, being to upgrade the current systems, or select a world-class package. Based on a comparison of the possible risks and benefits of the two alternatives, the company chose to go to the global software market to select a world-class package that best suited its current needs, and would serve future strategic visions and trends. ERP system selection is not a straightforward process, and can be a difficult and time consuming process. However, given the considerable financial investment and potential risks and benefits, the importance of a pertinent ERP system selection cannot be overemphasised (Teltumbde, 2000). It was important to the team that the system chosen would be a fairly flexible one, and that it would be easy to communicate and cooperate with a vendor who would be responsive to its customers' needs. As the selection of the ERP vendor is a critical step, that determines much that is to follow, the need for using a systematic framework in the vendor selection process was considered to be an important first step. Decision makers frequently adopt a number of common ERP evaluation criteria as a measure of the system requirements, without developing tailor made objectives and clear requirements that echo the company characteristics, its position in its competitive environment, and its corporate strategy. This approach can result in delays of the ERP implementation and in under-performance of the system. Hence, an ERP system selection framework is extremely critical in assisting executives to evaluate from the perspective of the operational requirements and strategies. Since the business environment is characterised by high uncertainty, the process of ERP system assessment can involve numerous problems.

It is emphasised by(Kumar *et al.*, 2002a), that installing an ERP system is much more than having another IT tool; it is a decision on how to shape the organisational business, and (Motwani *et al.*, 2002), state that ERP adoption, involves initiating appropriate business process changes as well as information technology changes to significantly enhance performance, quality, costs, flexibility, and responsiveness. However, many companies install their ERP systems hastily, due to time pressures and constraints, without fully understanding the implications for their business or the need for compatibility with overall organisational goals and strategies (Hicks and Stecke, 1995). The result of this hasty approach is failed projects or weak systems whose logic conflicts with organisational goals. A number of different methods have been proposed with regard to ERP selection, including scoring, ranking, mathematical optimisation, and multi-criteria decision analysis. The team having reviewed a number of these approaches, decided to use the Analytic Hierarchy Process

(AHP) method, introduced by (Saaty, 1980), which is a methodology which can be used to determine the priority of a set of alternatives and the relative importance of attributes in a multiple criteria decision-making problem, which has been well documented within the literature, and is illustrated in Figure 38.

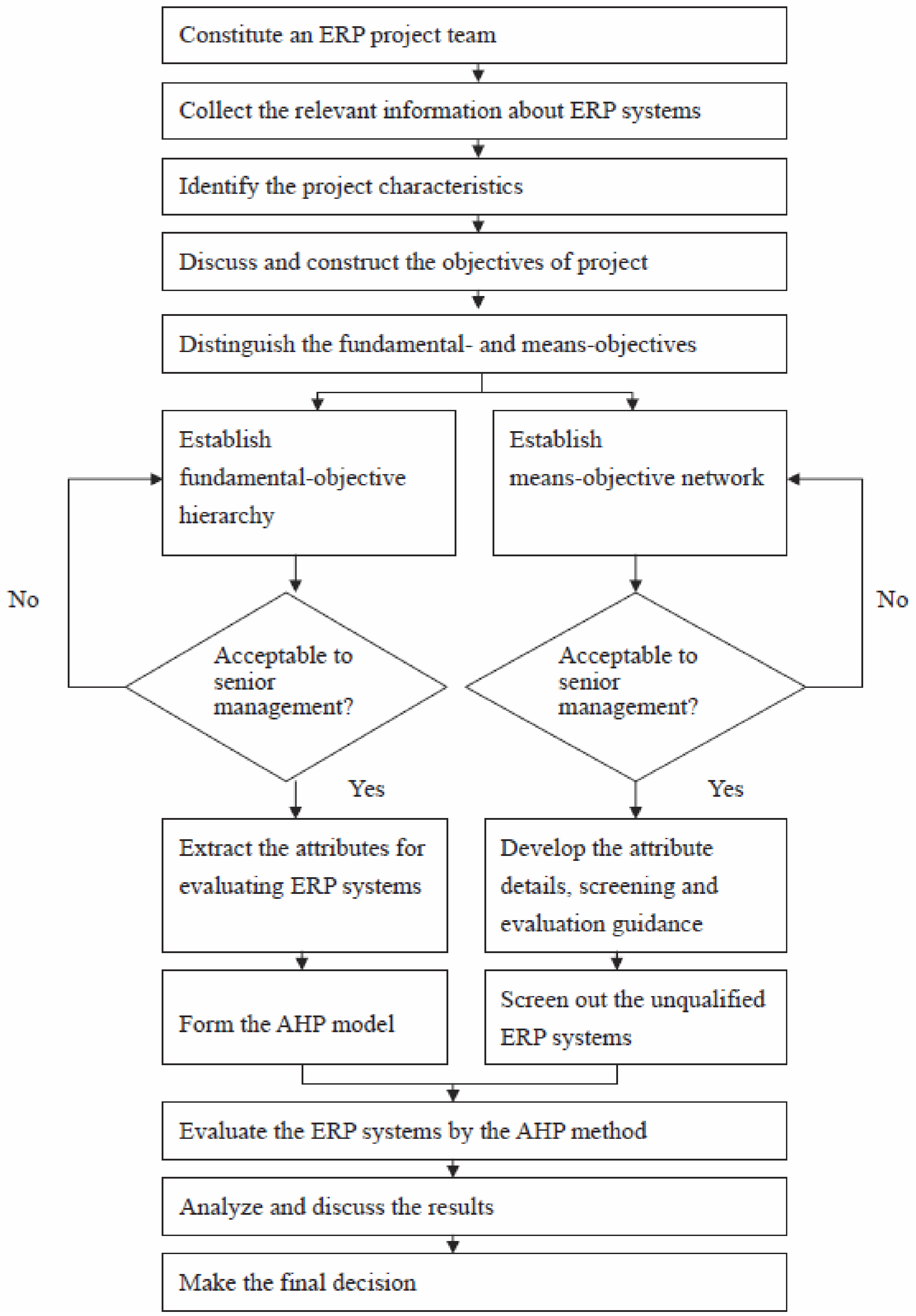


Figure 38: Comprehensive ERP Selection Framework. *Source: (Wei et al., 2005)*

The procedure consists of the following steps:

- ❖ Form a project team and collect all possible information about ERP vendors and systems.
- ❖ Identify the ERP system characteristics.
- ❖ Construct a structure of objectives to develop the fundamental-objective hierarchy and means-objective network.
- ❖ Extract the attributes for evaluating ERP systems from the structure of objectives.
- ❖ Filter out unqualified vendors by asking specific questions, which are formulated according to the system requirements.
- ❖ Evaluate the ERP systems using the AHP method.
- ❖ Discuss the results and make the final decision.

The process of scoping out the important strategic objectives based on this structure identified the following key objectives, the ERP system must be capable of:

- ❖ Satisfying the characteristics, and the business goals of the organisation and must be able to adapt to a dynamic business environment.
- ❖ Enhancing business process performance: to integrate business systems and procedures and enhance information transparency.
- ❖ Improving operations quality and efficiency: to standardise and simplify operations flow, improve quality and reduce lead times.
- ❖ Reducing turn-around time to the customer: to efficiently analyse customer information from various markets and quickly respond to various customer demands.
- ❖ Supporting globalisation development: to support business operations worldwide.

As a result of applying the analysis, an objective hierarchy was developed which is illustrated in Figure 39.

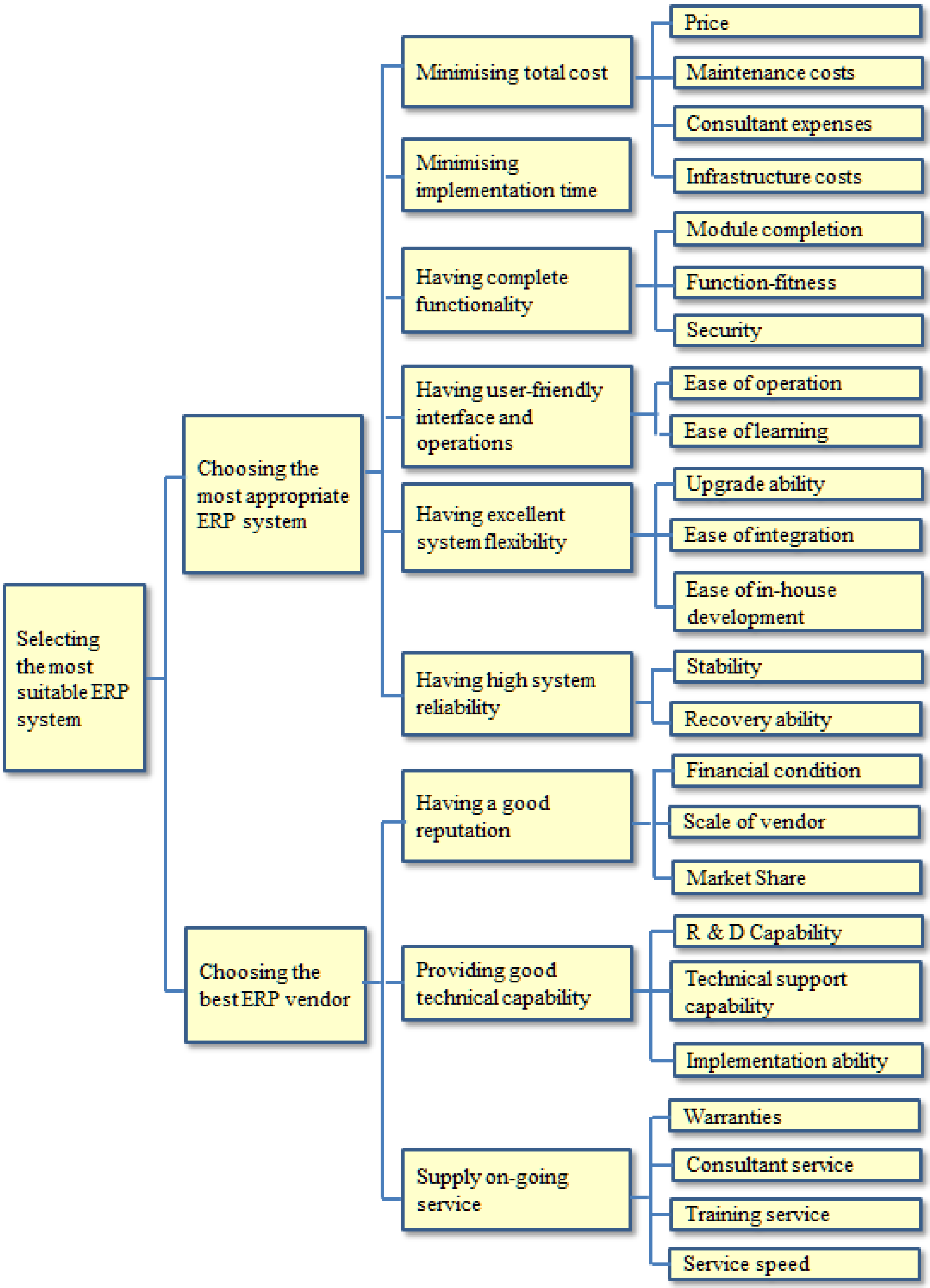


Figure 39: Objective Hierarchy. *Source: (Wei et al., 2005)*

After completing all the phases of the framework, it was decided, that in regard to the specific organisational requirements of PDV that, the capabilities embodied within SAP R/3, platform represented a solution which provided the closest alignment to the strategic requirements of

PDV, and it was therefore, chosen as the technology platform most qualified to fulfil these needs. SAP R/3 is an integrated suite of financial, manufacturing, distribution, logistics, quality control and human resources application systems (Bancroft, 1996). SAP's tight integration philosophy fulfilled the business requirement for organisational integration. Other factors that were also taken into consideration were that, industry consultants rated SAP as being the best for system capability, vision, and the ability to fulfil the vision. The company was anticipating achieving business benefits such as; more integrated, timely and reliable data, the, ability to handle new business opportunities, and cost reductions. The anticipated customer benefits included reduced pricing errors, increased fill rates and the provision of consistent and reliable information to its customers. The SAP R/3 architecture consists of three main layers of software: the SAP Graphical User Interface (GUI), representing the presentation layer; the SAP application layer; and, the SAP database layer. SAP R/3 brings together several core business functions into one integrated data model to provide for one-time data entry and the sharing of a fast, seamless access to one single facet of information (Martin, 1998, Mullin, 1997). Its potential for standardisation originates from its ability to close the gaps in both IT and business practices. Through its standardised software modules, it enables an enormous degree of connectivity and inter-operability within and beyond the organisational scope. It also narrows down the gap in business practices through its generic processes, which were originally designed based on best practices and standards, and thus becomes a vehicle for transferring and sharing business standards (Al-Mashari and Zairi, 1999). The SAP solution which was implemented, included modules supporting; purchasing, order entry, materials management, production planning, financial accounting, distribution and logistics, and asset management. The implementation and integration of the SAP R/3 ERP system required, that there be an adherence to a full and comprehensive integration of key elements within the programme. The key aspects of each of these elements are outlined below.

- The Business Case.
- Benchmarking.
- Implementation Strategy.
- Project Management Infrastructure.
- Change Management.
- Business Process Reengineering.
- SAP R/3 Installation.

SAP provides its customers with accelerated SAP (ASAP). ASAP suggests the adoption of a *"Big Bang"* implementation. This programme opts for a quick implementation that is specifically designed for small and medium sized companies, but the methodology is applicable to larger organisations as well. *"Big Bang"* implementations offer lower costs and generally use only a few of the software's interfaces however, the risks are greatly increased, as less time is spent on development and assessing business needs (Yusuf *et al*., 2004). The ASAP implementation methodology is a structured implementation approach that can help managers achieve a faster implementation with quicker user acceptance, well-defined roadmaps, and efficient documentation at various stages. The phases of the ASAP methodology are;

- Project Preparation: To provide initial planning and preparation of the SAP project. The steps of this phase help identify and plan the primary focus areas to be considered such as; objectives, scope, plan and definition of project team.
- Business Blueprint: To create the business blueprint, which is a detailed documentation of the results gathered during requirements workshops/meetings. It will allow the implementation project team to clearly define their scope, and only focus on the SAP processes needed to run the organisation business.
- Realisation: To implement business and processes requirements on the business blueprint. The objectives are final implementation in the system, an overall test, and the release of the system for production (live) operation.
- Final Preparation: To complete the final preparation, including testing, end user training, system management and cut over activities, to finalize the readiness to go live. The final preparation phase also serves to resolve all open issues.
- Go Live & Support: To move from a pre-production environment to live production operation. A support organisation must be set up for end users to provide long-term support. This phase is also used to monitor system transactions and to improve overall system performance. Finally the completed project is closed.

Each phase has a structure which is composed of a group of work packages. These work packages are structured into activities, and each activity is composed of a group of tasks. For each task, a definition, a set of procedures, results, and roles are provided in the ASAP roadmap documentation (ASAP 1999). Despite the increase risks involved, the ERP team decided that integrating elements of the six stage process already identified with the ASAP methodology, represented the most favourable progression route. The ERP team recognised that merely changing the current application system would not greatly benefit the company. The creation of a solid business case ensures that a SAP project is firmly tied to business-specific goals (Cooke *et al*., 1998), and it assists in controlling the scope of the programme, and helps to convince management and key personnel of the need for change, and it greatly assists in developing their commitment and receptivity to it (Stevens, 1998a). A study of 120 SAP projects shows that 70 per cent were initiated with a business case, and a global survey reveals that 92 per cent of the responding companies build business cases (Stevens, 1998b).

Having previously identified the necessity to establish CSF's, consideration was given to the methodology identified by (de Sousa, 2004), which is illustrated in Figure 40. This consists of two stages: first, using Process Quality Management (PQM), to establish the relationship between ASAP implementation work packages and CSF for ERP implementation projects, and then following this by a validation of the results by the use of independent experts. This can be achieved, by using the PQM methodology established by (Hardaker and Ward, 1987, Ward, 1990), which relates the CSF's to the relevant ASAP work packages. The steps in the methodology include:

- ❖ Define the mission: To implement the ERP system, according to the organisation's business and organisational needs, and then demonstrate that the ERP implementation will add value through the satisfaction of the organisation requirements previously defined. This mission reflects the intention of the whole group of people involved in an ERP implementation project.
- ❖ Define CSF: This was performed using the unified model proposed by (Esteves and Pastor, 2000).
- ❖ Define the processes: These are the processes that are defined in the ASAP methodology.
- ❖ Establish the relationship of CSF versus ASAP work packages.

This is achieved through the creation of a PQM matrix. For each one of the five SAP implementation phases a matrix such as the one illustrated, was created.

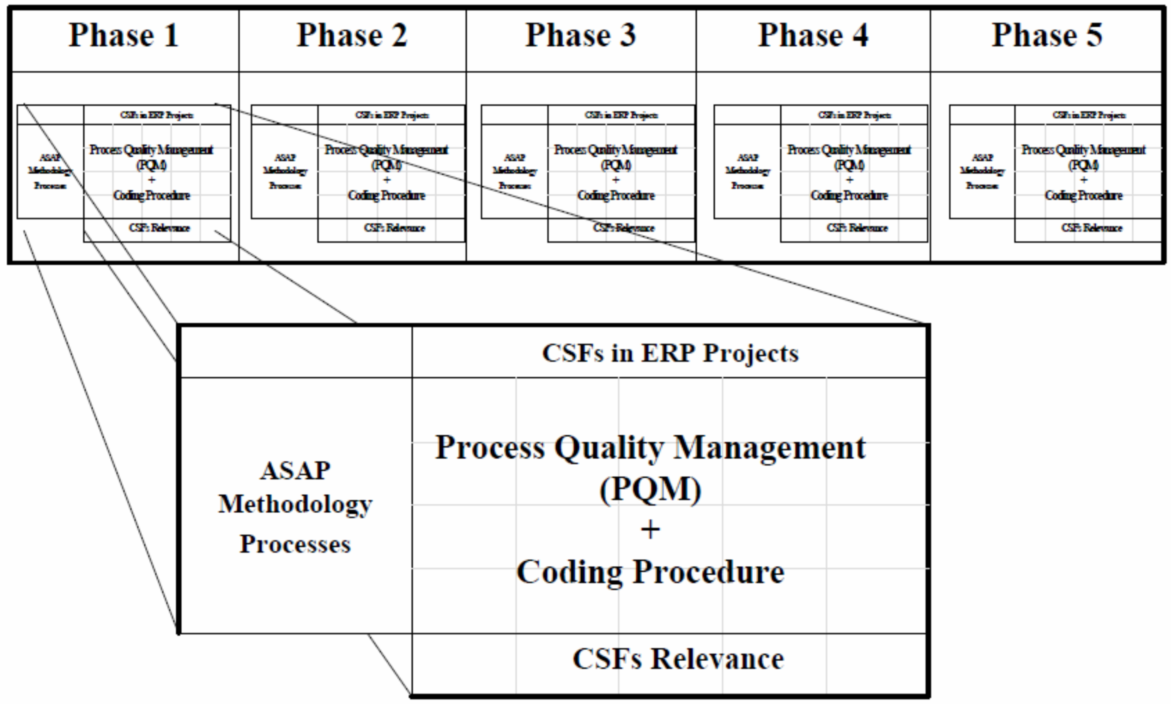


Figure 40: CSF Methodology. *Source: (de Sousa, 2004)*

The matrix has two axes: one represents the business processes and the other represents the CSF's. The management team focuses in turn on each CSF and considers the following question: *"Which business processes need to be performed particularly well for us to be confident of achieving this CSF?"* (Ward 1990). Many processes influence the achievement of a CSF but the team must judge which, are the truly critical ones. After the first pass a *"sufficiency test"* is applied: *"If the identified processes are performed well, are they sufficient to manage the CSF in question?"* If the answer is *"no"* then additional processes need to be defined. This analysis is repeated for all CSF's, each of which will have a different set of critical processes. After the definition of the processes which are most relevant for each CSF, there is the need to make an analysis of priorities, which is done by using three indicators:

- The count: The more important business processes are potentially those which impact most CSF's and a simple count is provided in a column in the analysis section matrix.

- Assignment of a *"quality"* rating: A *"quality"* rating for each process is provided in a column in the analysis section. This rating is normally the subject of considerable debate among the team. The *"basic"* ranking that PQM uses to assess the current quality of the business processes is:
    - A = needs no improvement
    - B = works well, room for minor improvement
    - C = functions, several areas for improvement
    - D =process in place but not functioning
    - E = embryonic
- Identifying the *"Big Burners":* In addition to *"count"* and *"quality"* a number of teams also identify the *"Big Burners",* those business processes that consume a significant proportion of the money, people or assets for which the team is responsible. The processes to which this test applies are designated with an asterisk in the *"Big Burners"* column.

According to Ward (1990), the Most Critical Processes (MCPs) are those *"processes whose performance must be improved if the CSF's are to be managed successfully."* The identification of MCPs is made through the creation of a matrix of CSF counts versus process quality rating. The project team must decide which zones have the MCPs. While all CSF's are equal in importance, the processes vary in their scope and the amount of the team's resources that is devoted to each of them. The general rule is that under no circumstances must the quality rating of a *"Big Burner"* process be allowed to slip; and where it has a current quality rating of *"D"* or *"C"*, immediate attention is required in the form of improvement processes.

Rel ij - Relationship between task(i) and CSF(j)	$\mathrm{Rel}_{ij} = \begin{cases} 1 & \text{if there exists a relationship} \\ 0 & \text{if there does not exist a relationship} \end{cases}$
Wp.n - Criticality of work package (n) within phase (p). Numtask is the number of tasks of work package n.	$W_{p.n} = \dfrac{\sum_{i=1}^{NumTask} \sum_{j=1}^{NumCSFs} \mathrm{Rel}_{ij}}{\mathrm{Numtask}}$

Formal definition of criticality indicator.

According to (Hardaker and Ward, 1987), *"the object of the exercise is to single out the essential activities and processes that have a primary impact on a particular CSF".* This is done in order to establish which ASAP work packages must be performed at a level of excellence to ensure the achievement of the CSF. One of the main findings resulting from this exercise is that organisational factors have more relevance along the SAP phases than technological ones. This emphasises the requirement to focus more on people issues and processes, rather than on the technology itself. This finding is collaborated by other research with regard to ERP programmes. The point is made by (Felix and Harrison, 1984) that, *"technical problems can usually be detected and repaired before the system is put in jeopardy. The cost may be high in terms of either budget or schedule, but the repair can be made. Organisational and personnel problems often cannot be redressed, and continue to jeopardise the success of the system itself".* The complete matrix established by (de Sousa, 2004), as a result of utilising this methodology is included in Appendix Five. The findings from this study were instrumental in informing management within PDV of the challenges that needed to be considered and addressed with regard to these issues.

5.3. Benchmarking

Benchmarking is *"the continuous process of measuring products, services, and practices against the toughest competitors or those companies recognised as industry leaders"* (Camp, 1989). In 1987, the Malcolm Baldridge National Quality Award established benchmarking as a major criterion for its award (Loomba and Johannessen, 1997). By one estimate, seventy-nine per cent of companies believe benchmarking to be essential for their survival. Benchmarking allows for the identification of the gaps within the current business performance (Zairi, 1992), and captures both external and internal best practices related to all aspects of SAP implementation, and transfers them across strategic and execution levels. The practice of *"benchmarking"* is critical to any reengineering effort and the constant performance improvement expected by firms involved in TQM (Kleiner, 1994). To measure the effectiveness of TQM and reengineering processes, firms must assess their performance against some external or internal standard (Stank *et al*., 1994). Such benchmark comparisons allow managers to identify the best practices and compare their firm's performance against leading edge performers (McCune, 1994), and depending upon a company's business goals, strategies and industry characteristics, suitable benchmarking methods can be selected (Brueck *et al*., 2003). Benchmarking emphasises the effort to identify practices and performance that are outstanding, and it then transfers those through adaptation and learning into another organisation (Brueck *et al*., 2003, Ettorre, 1993, Harrington *et al*., 1996). (Vasilash, 1994), identifies four types of benchmarking:

- ❖ Intra-organisational best practices.
- ❖ Best practices against competitors.
- ❖ Best industry practices.
- ❖ Best-in-class benchmarking.

Nine steps in the benchmarking process have been identified by (Mittelstaedt, 1992, Owen, 1992), which are; identifying what will be benchmarked, identifying benchmark companies, choosing a method of data collection and executing data collection, determining current performance gaps, projecting future performance levels, communicating benchmark findings, and gaining acceptance, establishing functional goals, developing action plans, taking action and monitoring results, and recalibrating benchmarks. Of these steps, determining what to benchmark, and identifying which firms to benchmark against, has been described as being the most critical aspects, with regard to a successful benchmarking outcome (Allio and Allio, 1994, Kleiner, 1994, Spendolini, 1992). An implementation strategy is critical for a successful outcome, as it guides the change of business tasks and workflows into integrated processes. A recent survey reveals that those organisations which had no implementation strategic plan experienced poor outcomes 90 per cent of the time (Cooke *et al*., 1998). In order to ensure a full alignment with overall business strategy, a SAP R/3 implementation strategy must be strongly based on both the business case developed and the results of the benchmarking. It should define clearly all aspects of implementation (Bancroft, 1996, Gibbs, 1998), including:

- ❖ Mission and vision statements.
- ❖ Well-defined multi-level implementation targets.
- ❖ Implementation guiding principles that describe the organisation approach to implementation.
- ❖ A project plan, describing phases of implementation, the time frame of each, and their anticipated outcomes.
- ❖ A reengineering strategy, defining methodologies, techniques and tools to be used in implementing the newly-redesigned processes.
- ❖ A measurement and auditing system by which progress can be continuously monitored against plans, and benefits in all dimensions can be measured by a set of key performance indicators.

PDV identified a number of key guiding principles that it utilised within the implementation phase, which included the following. The business processes were to be redesigned before the SAP project started, a business model was to be built to reflect how PDV wanted to conduct its business, and not what was possible through the availability of a given software package. A global configuration was to be designed to allow PDV to save time and money by implementing one system for all its business operations. The implementation phase required the participation of key personnel across the different functional areas and from different managerial levels, and the involvement of external entities such as customers and consultants. This critical demand necessitates a strong project management infrastructure, that:

- Provides a clear definition of roles and responsibilities at all stages of implementation.
- Determines forms and channels of co-operation and co-ordination, and decision-making.
- Ensures a disciplined project leadership.
- Defines procedures for team composition and development.
- Audits team performance, and detects any managerial problems early on; and
- Prevents any possible conflicts that might hinder the efforts.

5.4. Reengineering

BPR has been popularised in recent years as the most important technique for restructuring business operations to achieve improvements. However, the technique is not new. BPR originated in the 1950s as large enterprises began to explore the potential impact of computers on the efficiency and effectiveness of their business processes. In the early 1990s, BPR had an explosive dissemination, especially after the publication of the book by (Hammer and Champy, 1993), entitled *"Reengineering the Corporation: A Manifesto for Business Revolution"*. Another reason, is the fact that during the 1990s an increasingly competitive world was driving the use of BPR (Hammer and Champy, 1993), and business restructuring to improve profitability and return on capital employed (Martin and Cheung, 2000). According to (Hammer and Champy, 1993), BPR is:

"The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed."

While many academics advocate the necessity of BPR, not all of them agree on the same approach. Hammer's intervention strategy, which he has referred to as the *"neutron bomb"* approach to business improvement – *"We'll leave the walls standing and we'll nuke everything on the inside"*, (Childe *et al*., 1994), clearly exists at one extreme of a wide spectrum of opinion regarding the most appropriate BPR strategies for organisations to adopt. Hammer, for example, states that firms can only hope to achieve radical performance improvements using Business Process Re-engineering methods which strive to *"break away from the old rules about how we organise and conduct business"*. He asserts that re-engineering cannot be accomplished in small or cautious steps but must be viewed as an *"all-or-nothing"* proposition (Childe *et al*., 1997). There is an element of disagreement between those who favour an incremental or Zen type approach to BPR, and those who prefer *"root-and-branch*" radicalism where BPR improvement is concerned. Figure 41 illustrates that what can be achieved by the radical change proposed by (Hammer, 1990), can also be equally well obtained by more incremental change as advocated by (Davenport, 1993).

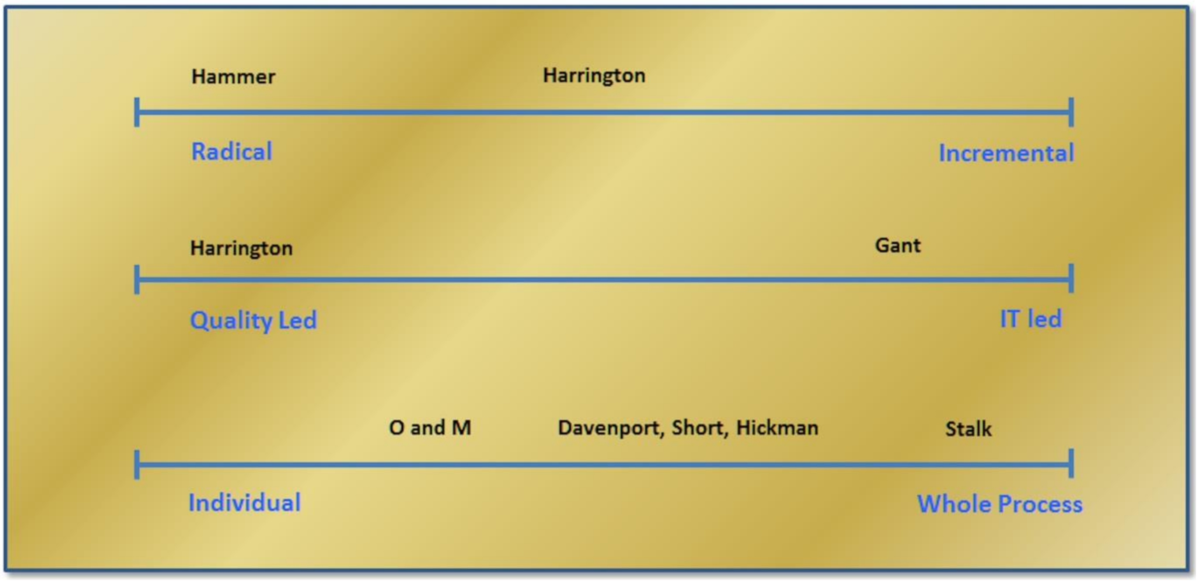


Figure 41: Useful Scales of Analysis. *Source: (Maull and Childe, 1994)*

For example, (Gant, 1992), sees BPR as simply *"…the redesign of processes to take advantage of the enormous potential of information technology"*. It has been noted by (Sturdy, 2010), that, as of this time, there is no agreement with regard to the use of BPR terminology within the broader business process community. Various authors have described approaches known as *"Business Process Reengineering", "Business Process Redesign", "Business Process Management", "Business Process Improvement"*, and *"Core Process Re-*

design"; their approaches have differing characteristics in terms of the degree of change (whether it be radical or incremental), the scope of the intended change and the focus of attention.

The approach advocated by (Hammer, 1990), in the author's opinion, should really only be undertaken, when all other possible approaches have been considered and eliminated as not being a practical solution under current circumstances. This approach is usually adopted when a company is in a crisis situation and BPR represents a last throw of the dice in order to ensure survival; in a number of these cases the BPR projects tend to fail as the circumstances that have brought the company to the critical point of a drastic fundamental rethinking of the redesign of operations can often mean that the company has already reached the point of no return in terms of business survival. It can be the case that incremental change can result in a dramatic change over a period of time, with this type of change being achieved without the tag of BPR being applied to it, yet the end results can be equally as dramatic. This does not mean that BPR should not be considered as a viable alternative approach to incremental change, but the business context in which it is undertaken should be a dominant factor in the consideration of its implementation. In this regard the more incremental approaches proposed by (Harrington, 1991, Davenport, 1993), have a higher probability of success, as the pressure of the business context should not be the dominant one. According to (Kræmmergaard and Møller, 2001), ERP systems pave the way for BPR since the implementation of ERP systems requires examination of many business processes (Boudreau and Robey, 1999, Taylor, 1998).

It can sometimes be difficult to ascertain if it is ERP that prompts BPR, or the other way around as sometimes, the boundaries of the two programmes can become quite blurred. Some organisations use ERP systems to promote BPR (Martin and Cheung, 2000), while others are driven into BPR during the implementation of an ERP system. The results of a survey of 220 European companies implementing SAP revealed that concurrent implementation of BPR and SAP R/3 is the most effective method for business improvement, and that the decision to implement SAP has led many companies to consider BPR. Like BPR, SAP R/3 focuses on business processes as the essence of business, and provides a means to move from an inefficient, costly, slow and complex, fragmented, function-based structure to a cross-functionally integrated, standardised, customer-focused, competency-centred, and process-based structure. Several approaches have been used to integrate BPR with SAP R/3 implementation. Choosing between them however, is highly dependent on the motivations for choosing SAP, the magnitude of improvement desired by the organisation, and the business situation (Bancroft, 1996). The most effective and most frequently used approach is reengineering to the SAP business model (Cooke *et al*., 1998). Based on a survey conducted by (Jarrar and Aspinwall, 1999), they have defined a set of CSF's for a successful BPR project categorised in four main aspects: culture, structure, process and information technology. A number of the CSF's in BPR projects (such as employee involvement, top commitment, training, assign the *"best*" people, involve outside consultants) are very similar to some of the CSF's in ERP projects (Esteves and Pastor, 2001). In both situations the organisational perspective is more important than the technological perspective. Based on field interviews by BPR experts, (Kettinger *et al*., 1997), consider four major project characteristics in BPR planning: project radicalness, process structure, and the potential for IT enablement, and customer focus. Figure 42 represents a summary of the main concerns in a BPR approach during ERP implementation projects.

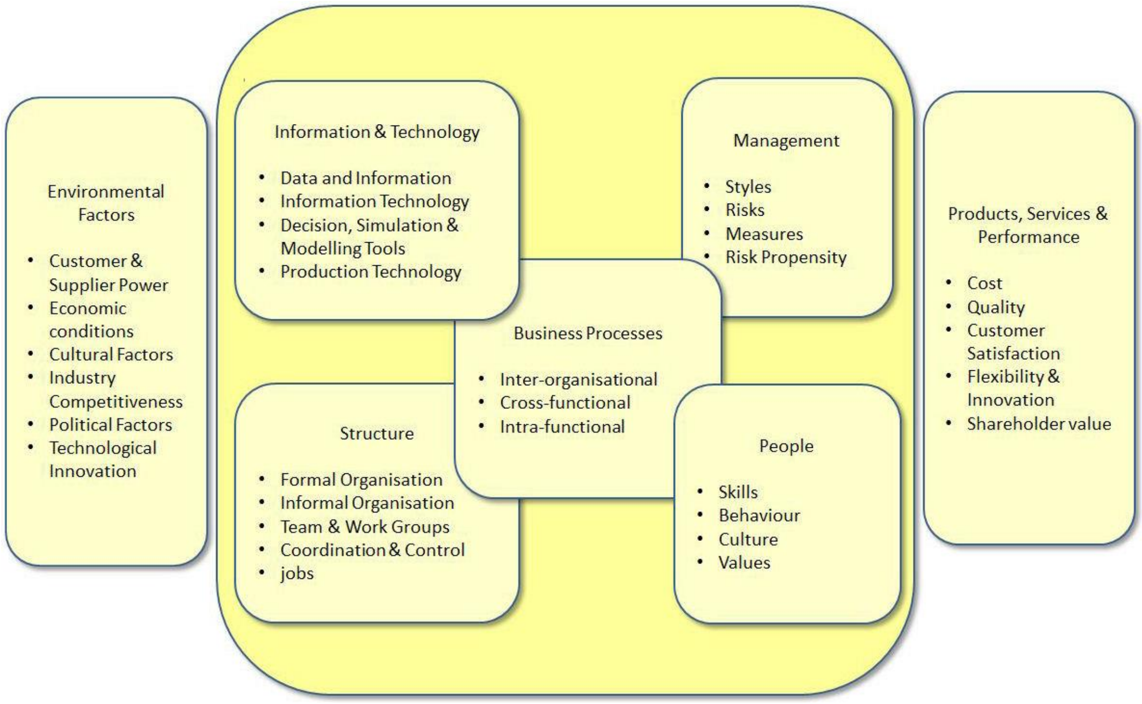


Figure 42: Business Process Change Model. *Source: (Kettinger et al., 1997)*

One of the first tasks that the PDV team chose to undertake, was the performance of a gap analysis in relation to the present *"AS-IS*" capabilities of the organisation and the desired *"TO-BE"* position. A number of proponents of the classic BPR approach have been somewhat negative about performing *"AS-IS"* analysis. This relates to the analysis of the existing situation before any change is attempted. They instead advocate a *"clean-slate"* approach. The reason given for this stance is that the analysis of the current situation can lead to incremental rather than radical innovation. This reflects a fear that the new process will remain rooted in the current process model. Michael Hammer stated that; *"Analysis is a profound waste of time"* (Hammer, 1995). Other proponents of this approach argue that modelling of current processes can lead to *"paralysis by analysis"*. The author does not agree with this approach. In a survey of nearly 50 successful organisations undertaken by (Carr and Johansson, 1995), it was established that modelling of current processes was a *"best practice approach"* leading to success. This approach ensured that nothing gained from previous experience was lost, and it also helped in identifying the best parts of the current practice which could be used to aid in implementing the new *"TO-BE"* process. The ERP process as implemented in PDV consisted of five major stages as illustrated in Figure 43.

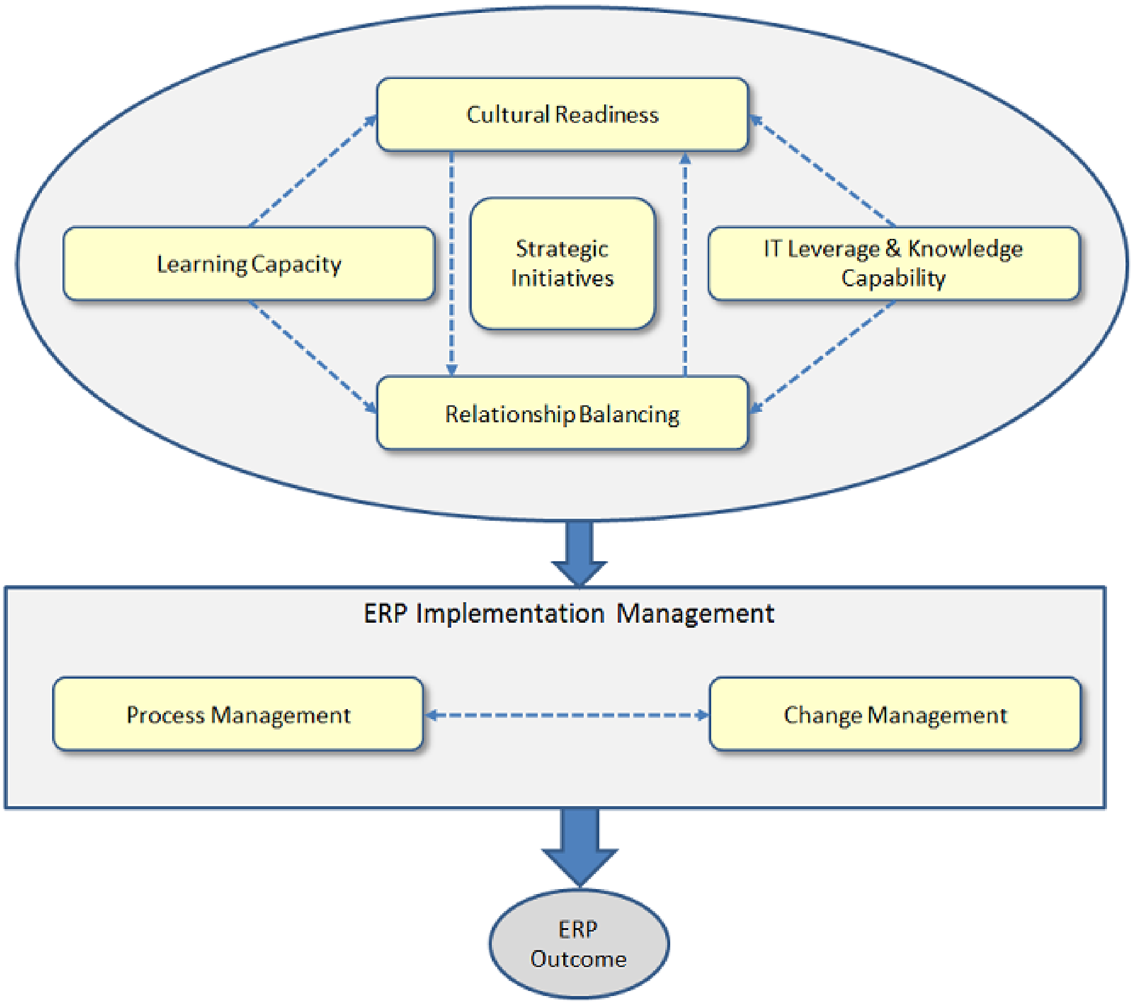


Figure 43: Theoretical Framework for ERP Implementation. *Source:(Kettinger et al., 1997)*

Making a business case for ERP requires that a link can be demonstrated between the ERP strategy and the firm's financial performance. The literature indicates that many corporate-level executives do not fully recognise its impact on all areas of financial performance, and that many ERP professionals, do not speak the language of finance, failing to articulate the real value of their solutions at the corporate level. Business processes can be regarded as the basis of the value addition within an organisation that has been traditionally attributed to various functions or divisions. As organisational and environmental conditions become more complex, globalised, and therefore competitive, processes provide a framework for dealing effectively with the issues of performance improvement, capability development, and adaptation to the changing environment. The understanding of value-adding and non-value-adding processes is a significant factor in the analysis, design, benchmarking, and optimisation of business processes in the companies leading to BPR.

Organisational and environmental conditions are continually becoming more challenging and globalised. Therefore, competitive, processes provide a framework for dealing effectively with the issues of performance improvement, capability development, and adaptation to the changing environment. Value Added can be defined typically as:

$$\text{Value Added} = \frac{\text{OUTPUT VALUE}}{\text{INPUT RESOURCES VALUE}}$$

Figure 44 illustrates this relationship between Output Value vs. Input Resources Value for SAP driven business processes, compared to business processes based on traditional IT systems. Information made available by ERP's like SAP is not only a substitute for tangible resources like money, manpower, materials and time, but it can also be utilised on a continuous and repetitive basis.

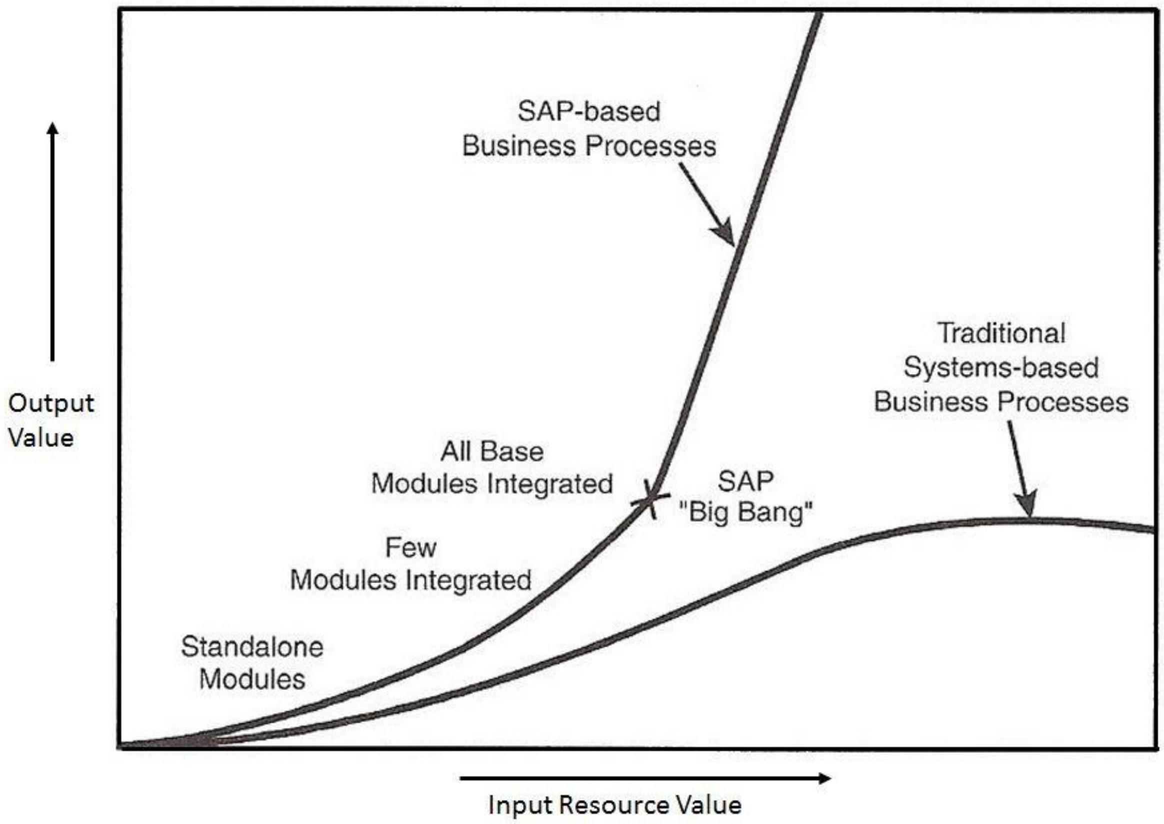


Figure 44: Resource Relationship. *Source: (Kale, 2000)*

This clearly explains why the Value Added component in Figure 44 rises almost vertically for SAP-driven organisations. This also indicates that only when the basic modules of SAP are operational and fully integrated does the system truly begin to utilise information as a resource resulting in significant gains in productivity. Up until that point, the system is only functioning as a recording system albeit, a somewhat inefficient one. This phase can be a very critical one, as it is at this point, that a lot of resources have been invested into the ERP system, yet the benefits to be accrued from it have not yet been fully realised. It is at this point that the detractors of the system can have a powerful impact. PDV made a specific point of allaying user concerns at this particular time, in order to ensure continued user buy-in.

5.5. Legacy Systems

Legacy IS migration involves migrating an existing IS into a target IS. Like many other organisations who have had to face similar challenges, PDV had to face the reality of their "*IS errors of the past",* which included, such things as, systems containing a lot of old code using a legacy database service. None the less, these systems were critical to operations and had to remain operational. Issues of this this nature can inhibit organisations from moving to next generation software, such as client-server configurations, current generation DBMSs, and fourth generation languages. Consequently, organisations are prevented from making the leap from large mainframe computers to smaller, less expensive computers that fully meet current application systems requirements.

Before planning and implementing the new technology platform, the PDV team needed a comprehensive view of all systems that would be affected by the migration to the new platform. A key task for the team was, to acquire a complete understanding of the legacy systems, that currently existed from both a technical and architecture perspective in order to gain a fuller understanding of the impact of the technology migration within PDV. The IT organisation was required to document how all existing application systems connected and communicated in regard to data flows to ensure that data was not compromised in the new implementation. This enabled the team to have a full understanding of the impact that the new technology would have on the overall environment. Along with this, other possible technological changes to provide further improvements within the overall solution could be considered and delivered as well. It was therefore, necessary to identify the various integration and reporting considerations within each of those application systems. The team created a graphical representation of the existing organisational application systems, which defined every connected system and data component. Once the view of the current structure was understood and approved, a graphical representation of the proposed structure, which replaced several systems and affected numerous others, assisted the organisation to better plan and execute this major system migration.

By exposing every data integration point that existed in the legacy environment, and how data integration would change in the new situation, this greatly benefitted the team's ability to plan and execute the system migration, and to ensure that data would not be compromised or corrupted in the process. A major challenge that the team faced was how to replace legacy systems that had been built on a myriad of outdated technologies, which had led to a high-cost support structure. The intended ERP system was expected to standardise much of the existing IT environment with the intention of leading to lower cost support. It was therefore, important to reduce the number of interfaces with existing systems to the greatest extent possible. Over time a number of systems had developed which did not integrate effectively with each other. This had the effect of making the firm's underlying information platforms somewhat inefficient and unreliable, and this represented a challenge for the team. An important aspect of the integration was to ensure the capability within the system to provide *"data visibility"*. Because ERP's are highly integrated, they have the potential to make much better decision-making information available to managers. This visibility, which gives an end-to-end view of supply chain processes, provides a much improved platform, for making operational decisions. The impact of data visibility provided the capability to extend the strategic decision-making process throughout the organisation. These real-time transaction processing characteristics of ERP's therefore, provide current rather than historical information on a firm's performance thereby, facilitating increased responsiveness to market conditions, through increased and new internal capabilities.

5.6. Going Live

Within a typical ERP project life-cycle, which is illustrated in Figure 45, it is in the *"Go Live"* or deployment phase, that many of the more challenging aspects of implementation can be encountered.

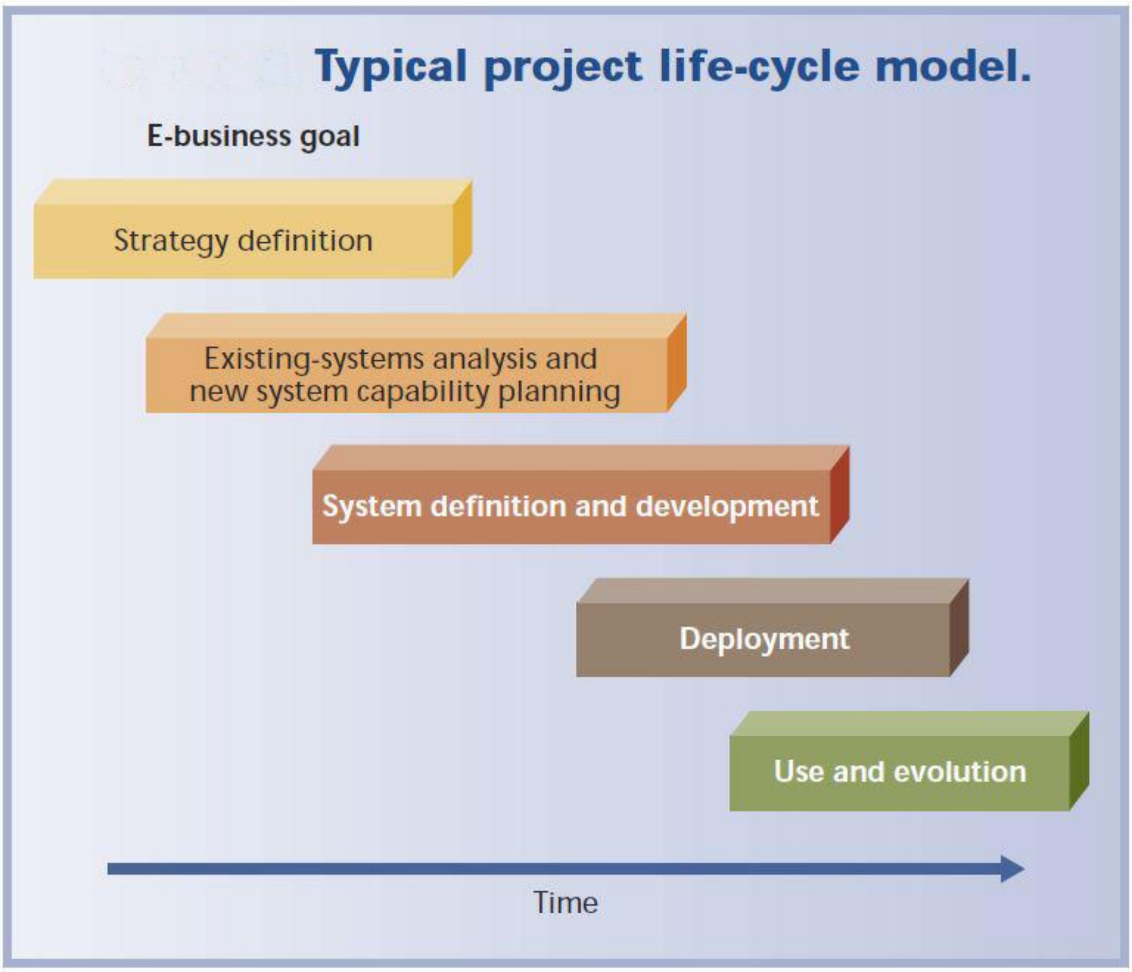


Figure 45: ERP Project Life-Cycle. *Source: (Krasner, 2000)*

Whereas up until this point, many of the implementation aspects were of a technical or managerial nature, now issues relating to human interaction come to the fore. There is no doubt that ERP projects have acquired a reputation for being failure-prone. Davenport when writing for the Harvard Business Review stated the following;

"*ERP systems are expensive and difficult to implement. The growing number of horror stories about failed or out of control projects should certainly give managers pause. ... Some of the blame for such debacles lies with the enormous technical challenges of rolling out enterprise systems - these systems are profoundly complex ..., and installing them requires large* *investments of money, time and expertise ....The biggest problems are business problems. Companies fail to reconcile the technological imperatives of the enterprise system with the business needs of the enterprise itself."* (Davenport, 1998c)

Here, Davenport's statement that the *"biggest problems are business problems"* is well supported and documented within the literature. From the study conducted by Deloitte and Touche (Deloitte, 1998), the section of it which focused on the *"Going Live"* aspect of ERP implementations, noted that problems within this phase occurred in the following proportions; people obstacles (62 per cent), process issues (16 per cent), and IT issues (12 per cent). Therefore, no matter how well the ERP solution is accomplished from a technical perspective, if the managerial aspects are not handled correctly, then failure of the entire project is still highly likely. In order to avoid failure at this point in the programme, PDV put a good deal of effort into ensuring that the implementation of this aspect of the programme, would lead to success. The project team maintained an integrated focus during this phase and they ensured that communications with all the key players were maintained throughout all phases of the programme. This does not mean that technical issues are of a lesser importance, they are not, and issues in this area need to be addressed with equal importance.

An ERP system cannot exist in isolation and it must interface with the existing IT structure. The interfaces between these systems are complex and significantly affected by the overall IT integration approach. PDV ensured that through rigorous legacy-systems analysis the ERP team were fully informed with regard to the ERP-interfacing requirements, and all major interfaces were identified and documented. In order to deal effectively with issues within this area, an effective middleware solution was employed to interface the various systems and applications over the entire distributed ERP system. The middleware solution was accomplished through the use of the Common Object Request Broker Architecture (CORBA). The CORBA provides a conceptual *"software bus"* that allows applications to communicate with one another, regardless of who designed them, the platform they are running on, the language they are written in, and where they are executing (Seetharaman, 1998). The use of the CORBA system, proved to be a very effective solution in this regard. Another issue that has proved to be problematic within ERP implementations is that of customisation. Very few ERP packages have the ability to deal with every specific business requirement, and a certain amount of customisation is inevitable. In order to avoid problems in this area, the amount of this customisation needs to be kept to an absolute minimum. The PDV team put a great deal of thought into the code development, which avoided problems associated with poor-quality code. This approach also reduces the problems and costs associated with custom code when upgrades to the system are required.

5.7. Business Intelligence Solution

Despite the very successful implementation of the ERP system within PDV, it was recognised by senior management, that although the ERP system was very successful in resolving quite a number of issues within the organisation, many of these problems were internal to the organisation and they did not represent the complete solution that they were looking for in terms of competing within the external environment. In chapter two, it was noted with reference to the Deloitte survey that many organisations realised that ERP within itself, did not represent an all-embracing solution to their problems, see question seven, in appendix three. The need for complementary solutions through the use of alternate technological solutions was clearly identified, which is illustrated in Figure 46. Of particular concern to the management team were the two issues of CRM and Electronic Data Interchange (EDI). Management at PDV were aware, that the days of offering a personal shopping experience to individual customers within their stores was something, that was of the past, and that this type of service, in the main, was no longer possible. However, they realised the importance of targeting specific customer segments, and of providing a personalised experience to their customers, based on the data that they already held in relation to each customer. They therefore decided to pursue a Web based CRM strategy in order to accomplish this.

Effective CRM has become a strategic imperative for companies in virtually every business sector. Enabled by advanced information technologies, companies can now collect a significant amount of in-depth data in relation to their customers, and, then utilise the information for their strategic business purposes. Here, the important issues are: to identify what kind of information they need; about whom they will collect this information; and how they will manage such information for future use (Park and Kim, 2003). Companies are moving closer to their customers, expending more effort in finding new ways to create value for their customers, and transforming the customer relationship into one of solution finding and partnering rather than one of selling and order taking (El Sawy and Bowles, 1997). Organisations will be more successful if they concentrate on obtaining and maintaining a share of each customer rather than a share of the entire market (Peppers and Rogers, 1995). It has been illustrated in practice that retaining an existing customer is more profitable than acquiring a new one (Reichheld and Sasser, 1990).

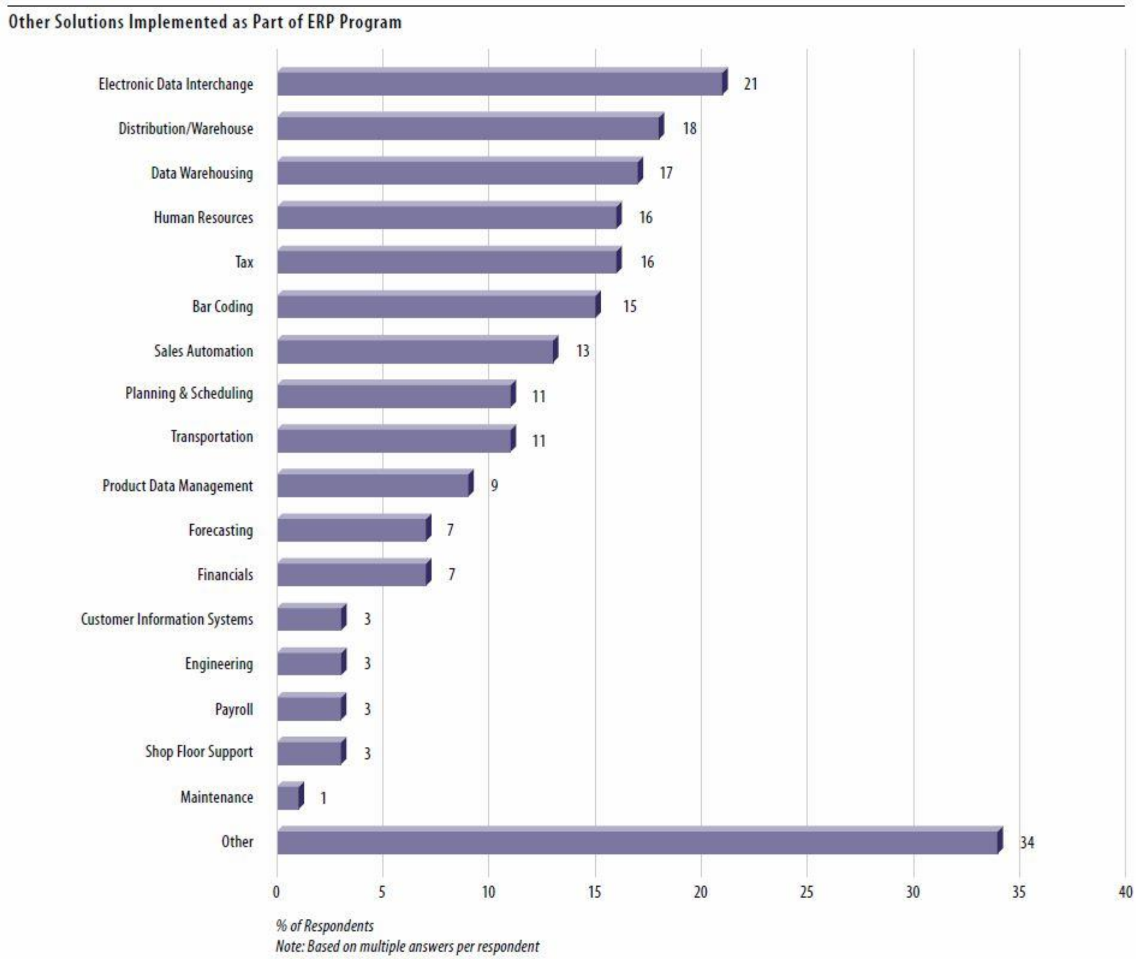


Figure 46: Alternate Technological Solutions. *Source: (Deloitte, 1998)*

In order to meet the requirements of the vision that they had in mind, PDV decided to create an alternate e-commerce channel to complement its existing retail outlets. It has been noted by (Gulati and Garino, 2000, Griffith and Krampf, 1998), that electronic commerce provides a new sales channel for traditional retailers yet many traditional retailers have been slow to embrace the new technology (Bellman, 2001, De-Kare, 2000, Maruca *et al*., 1999). However, other, *"Clicks & Bricks"* retailers have successfully integrated physical operations with online stores (Enders and Jelassi, 2000, Willcocks and Plant, 2001). A company that utilises a BI system possesses distinct advantages over its market rivals. What a company knows about the customers, vendors, partners, products, and market will allow its executives to make strategic decisions that may result in dramatically revenue increase, cost reduction, and profit enhancement. Distinct from conventional reporting tools such as spread-sheets, BI reporting tools provide a visual interface for accessing and navigating through multidimensional data sources that are stored in transactional systems. This means that decision makers and analysts will have easier and faster access to frequently updated information, which supports quicker and better decision-making. A powerful BI tool can generate a number of different views from available data within the system. A scaled data mart or data warehouse can provide rich, timely, and well-structured and cleansed information to the BI tool. After performing an evaluation exercise in relation to its BI requirements, which was very similar in nature, to that used for the ERP system, PDV decided to go with Teradata, which is one of the world's largest companies with a sole focus of creating enterprise solutions through database software, enterprise data warehousing, data warehouse appliances, and analytics. Their CRM solution is based upon the Teradata Retail Logical Model for retailing, which is an industry model which can be applied to a variety of different firms within the same sector. The major advantage of using an industry data model is that it avoids all the pitfalls associated with customised solutions, and as it is built upon the experience gained from multiple users, it reflects best practice within the industry.

For the reporting and scorecard elements of the CRM solution Teradata used MicroStrategy, which provides integrated reporting, analysis, and monitoring software that enables companies to analyse the data stored across their enterprise to make better business decisions. MicroStrategy's BI platform delivers actionable information to business users via e-mail, Web, and mobile devices, including the iPhone, iPad, and BlackBerry portable devices. At the core of the Teradata solution is an Enterprise Data Warehouse (EDW), which is capable of storing terabytes of data. Data comes into the warehouse from a number of sources, which include; POS systems, from within the ERP system, customer service data, click stream data, and order fulfilment data. The data is loaded into the warehouse using Oracle Data Integrator ETL software that extracts and cleans the data from the source applications and then loads it into the EDW. Data from the POS terminals is entered into the system in real time, while other data is loaded on a weekly or monthly basis, depending on the source.

5.8. Neuromarketing

PDV were fully aware of the benefits to be derived from having its own Website which would act as a major e-commerce channel for the organisation. Prior to embarking on this part of the BI programme, there were a number of senior managers within PDV who wished to explore how developments within the area of Neuromarketing could be researched and brought to bear, with the intent of maximising the profitability of this area of operations.

There has been an explosion in the abilities of neuroscientists to directly study cortical activity in terms of frequency, time, and space, within recent years. The psychological and physiological sciences have been quick to apply these techniques to make considerable advances in our understanding of how the brain operates, particularly in the area of cognition. However, most social sciences have yet to utilise neuroimaging as a fundamental tool, or procedure for research. Marketers seek to understand and influence the intricate processes of evaluation and selection by consumers, so as to allow the use of various technologies to redirect decision makers without them being aware that their decision making is being influenced in any way. The term *"Neuromarketing*" (NM), is a relatively new one. Jerry Zaltman has been credited with coining the term, initially proposing a union of brain-imaging technology with marketing in the late 1990s. NM has been described as *"applying the methods of the neurology lab to the questions of the advertising world"* (Thompson, 2003). The International Journal of Psychophysiology called NM *"the application of neuro-scientific methods to analyse and understand human behaviour in relation to markets and marketing exchanges"* (Lee *et al*., 2007). Researchers have applied MRI techniques and technology to investigate the nature of decision making and persuasion. Within their preliminary experimental work (Knutson *et al*., 2005), found the neural activity associated with the calculation of expected value. They measured the brain activities of participants who were provided an informational cue about the probability and magnitude of gain or loss at the beginning of an experiment. The task was to push a button within a time limit that varied with the probability of receiving the reward. From these experiments, it was established, that activation of the subcortical nucleus in the forebrain is related to magnitude of payoff but not probability of gain, while activation of the mesial prefrontal cortex is correlated with magnitude and probability of gain. These findings demonstrate that such evaluations involve both affective and cognitive neural systems (Wilson *et al*., 2008).

Complementing the scholarly research, a number of university neuroscience programmes, are teaming up with private consulting firms to do applied research for large organisations. More than 90 private NM consulting firms currently operate in the United States as well as in an increasing number of other countries (Reid, 2006). The media has sensationalized quite a number of these investigations, alleging that marketers found the *"buy button in your brain"* (Dias, 2006). Marketers have used the principle of *"customer satisfaction"* for at least the last four decades; assuming the marketing concept had accurately captured a prime consumer motivator. Unfortunately, satisfaction is a short lived phenomenon. Surveys indicate that even satisfied customers tend to shop around and go elsewhere on a regular basis. The explanation to this particular conundrum may lie inside the brain. The striatum in the brain quickly gets used to new stimuli and tends to react only to the unexpected (Coy, 2005). This provides a neural-based explanation why marketing experts now exhort us to *"delight"* our consumers instead of simply satisfying them (Fugate, 2007). This demonstrates the point that, providing customer satisfaction is the minimum that is required by marketers to achieve their target market. To elevate customers to that point where they deliver value back to the firm, marketers must find the crucial emotional connections that create customer engagement and passion, emotions that can be discovered and tracked as neural activity. According to (Renvoisé and Morin, 2005), seven techniques that boost the response of the Brain to any given message.

- Use *"You",* using the word you, makes your customers take ownership of your solutions.
- Be Credible, your passion, energy and conviction can be sensed by your audience.
- Show Contrast, when you create a sharp difference between the dissatisfaction your customers experience before your solution, and the relief of the satisfaction with your solution, you create more impact on the Brain which helps it make a decision.
- Trigger Emotion, strong emotions create a cocktail of hormones in the brain that act as a memory maker and as a decision trigger.
- Vary Learning Styles, varying learning styles keeps the Brain attentive and gives every member of the audience an opportunity to receive information through the channel they are most comfortable with.

- ❖ Tell Stories, good stories make a concept visual and tangible. A good story can make your presentation personal and generate powerful emotions in your audience.
- ❖ Aim for less; remove everything from your message that has no direct value to your customers. Moreover, customers will appreciate that your messages can be delivered in half the time, but with more impact!

To this list the author would add an additional item, and that is to use the word *"Free"*, this can dramatically increase clicks. Offering free shipping or another incentive such as a percentage, or savings in real money terms will compel users to click faster and more frequently. Although consideration was given by PDV to these techniques, particularly in the design phase of its Website, a focused programme concerning NM was not developed.

5.9. Website

Much of the data that is generated within the PDV warehouse emanates from the purpose built Website, which represents the electronic e-commerce channel and interface of PDV with its customers. This Website was designed to have the look and feel of well-established electronic retail giants such as Amazon, Wal-Mart and EBay. Some of the issues which were taken into consideration during the development phase of the Website were as follows.

- ❖ Which is the best mix of media elements that should be deployed to achieve an optimum communications strategy?
- ❖ How effectively can digital media be combined with other media?
- ❖ What kind of online communications, best influence a brand's image and reputation? To what extent can the impact that online advertising has on bricks-and-mortar distribution networks be measured?
- ❖ How can targeted advertising formats and techniques be best utilised to achieve the marketing objectives?

Within the current business environment, the Internet is at the core of communication and consumption behaviour. Research within the U.S. indicates that, Internet users spend 58 minutes watching video or surfing on the Web. 78 per cent of Internet users state that they consult a Website before buying a product. As social networks develop, the Web has also become a place where a brand's reputation and image is shaped. In 2009, 24 per cent of French Internet users interviewed by IFOP responded that they could be enticed to buy a product advertised online. In 2010, eight out of ten Internet users interviewed by Médiamétrie reported consulting a Website before purchasing a product (Fevad, 2010).

When a new customer logs into the Website a cookie is automatically placed on their P.C. This assigns an I.D. to the customer. This same I.D. is stored within the EDW. When the customer next returns to the site, they are automatically recognised. All the clickstream data relating to what areas of the site the person has visited is captured and stored in the EDW. The system employs intelligent algorithms which are used to analyse any purchases the customer makes and these algorithms determine what is displayed on the screen based on the purchases that are made. Using real-time analysis a market basket analysis is also performed, so that when the customer goes to the check-out screen, additional complimentary products are now displayed. This market basket is based on an analysis of additional items that others customers purchased with these specific products. Before the customer can check out and pay for the purchases, they are encouraged to register as a new customer. This now provides PVD with a raft of additional data, such as the customers; address, telephone number, credit card details, email address, along with the login I.D. and password.

All of this information combined with the clickstream data and other information provided by the cookie is stored in the EDW. Combining all of the information together, enables PDV to target individual customers with informed and personalised emails, which contain marketing information based upon their previous choices within the PDV Website. Not only will customers now receive, emails in relation to items purchased and shipped, but they will also receive additional emails relating to promotions and sales on products based on the customer's previous shopping behaviour. Again, an algorithm decides who will receive these types of emails and the frequency at which they are sent. PDV are very aware that if they send too many of these emails, they could quickly become regarded as spam. PDV performs market segmentation analysis in order to identify those customers who are most likely to be receptive to a specific offer. This analysis is performed on the basis of customer specific events, such as; anniversaries, purchase cycle, product interest, and sales. The algorithms are designed to send emails, immediately after a purchase, which is a time when they are expected, and also if there is a pause in the person's use of the site, these customers will receive an email containing an attractive coupon to encourage them to return to the site. In this way PDV are able to offer a personalised experience to every customer that uses its Website, which results in benefits for both parties. Customers feel good about being treated in a personalised way, because PDV appears to react to their specific needs and preferences.

While at the same time PDV benefits from greater customer loyalty, increased revenues and profits.

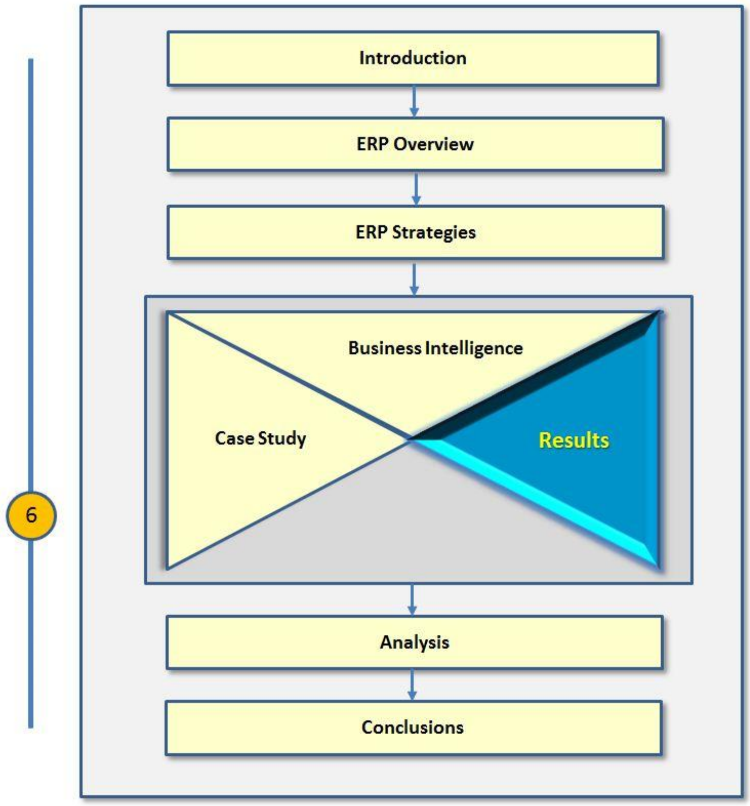
Many customers come across Websites such as PDV as a result of entering key-words into a search engine like Google. It is a well-known fact that many people never look beyond the first page of results that are returned, after entering in their key words. Therefore, how highly your site is ranked in terms of the key words is a matter of great importance to Website developers. Although Google now dominates the search engine market, it was not the first of the search engines to come into existence. There were many search engines in existence prior to Google, like HotBot, Excite, WebCrawler, Lycos, and Infoseek. However, the great weakness of many of these search engines was that they were unable to provide results based on relevancy. They could return thousands of references to your search words, but absolutely randomly. The way that they ranked the results was by counting the number of times the keywords appeared on the indexed pages and then listed them accordingly. Many Web developers took advantage of this fact and stuffed their pages with the relevant key words in an attempt to increase their chances of being indexed. This was a practice that Google frowned upon, and they began to punish Web masters who employed these and such like practices.

One day while analysing the search results from a search engine called AltaVista, Larry Page (a cofounder of Google along with Sergey Brin), noticed that the returned results from Web-searches contained links to other Websites. He then hit on the idea of analysing the relevancy of these links. Page developed a theory that the number of links pointing to a Website could be a way of ranking the site's popularity. This led him to another conceptual breakthrough, and that was the ranking of a site could also be measured by the importance of the sites that it linked to, because some sites mattered a lot more than others. Another technique he employed was that of establishing back-links, these are links from other sites into the site in question. He likened this to the process of *"citation",* within academic publishing, both the quantity and quality of citations to any particular published work has the effect of increasing the relevancy of both the work and the author. Therefore, if a very important site was creating links to your site, this had the effect of increasing its ranking dramatically. If for example, Amazon or EBay provide a link to a site, then that site instantly becomes more important. From this he developed an algorithm which he called PageRank, which has become one of the cornerstone software technologies of the Google search engine. PDV were very aware of this technology, which required their Website to be *"tuned"* in terms of search engine optimisation. This is an on-going task that receives constant attention by a small group of experts, in order to ensure that the Website continues to be ranked highly in search results.

Chapter 6

Results

"*It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.*" - Charles Darwin



Before going directly into the results, the reasons underlying the PDV strategy to implement a multi-pronged approach with regard to its e-business strategy will be discussed. As noted within the introduction, PDV had become aware of the forces that were bearing upon them in relation to their competitive position within the marketplace. Management within PDV wished to be able to establish their existing competitive position, not only, would this inform management of their competitive position compared to its competitors, it would also inform the decision making process with regard to the strategic path forward. The main functions of strategic management have been explained by (Robbins *et al*., 1997), as identifying the organisation's current mission, objectives, and strategies, analysing the environment, identifying the opportunities and threats, analysing the organisation's resources, identifying the strengths and weaknesses, formulating and implementing strategies, and evaluating results. According to (Schermerhorn Jr, 2010), strategies must be well formulated and implemented in order to attain organisational objectives. Strategy formulation is the process of choosing among the various strategies which can realistically be pursued, based on analysis, and adapting them to fit the organisation's actual circumstances. It is therefore, the responsibility of senior management to formulate a strategy that makes the most effective use of core resources and capabilities, and (Grant, 2002) states, that these resources and capabilities play a pivotal role in the competitive strategy which a firm pursues and these are the firm's *"crown jewels"* which, need to be protected.

Strategic thinking and decision making are the essence of strategic management and they should be directed to do three fundamental things (Choo, 1992). These are; first, determining strategic direction and long-term performance of the organisation, second, providing a set of managerial decisions, and thirdly, guiding the priority use of resources and internal managerial decisions, also (Christensen *et al*., 1998), among others, have stated that strategic management is comprised of two independent strategy processes. The first strategy-making process is conscious and analytical, involving assessments of market structure, competitive strengths and weaknesses, the nature of customer needs, and the drivers of market growth. The second strategy-making process has been termed emergent strategy. It is the cumulative effect of day-to-day prioritisation decisions made by middle managers, engineers, sales people and financial staff. These are decisions that are made despite, or in the absence of intentions. Figure 47, illustrates the confluence of these strategy-making processes. It has been determined by (Schermerhorn Jr, 2010), that the strategy implementation process includes the many components of management and has to be successfully acted upon to achieve the desired results. Here, the critical point is that effective and successful strategy implementation depends on the achievement of good *"fits"* between the strategies and their means of implementation (Taslak, 2004).

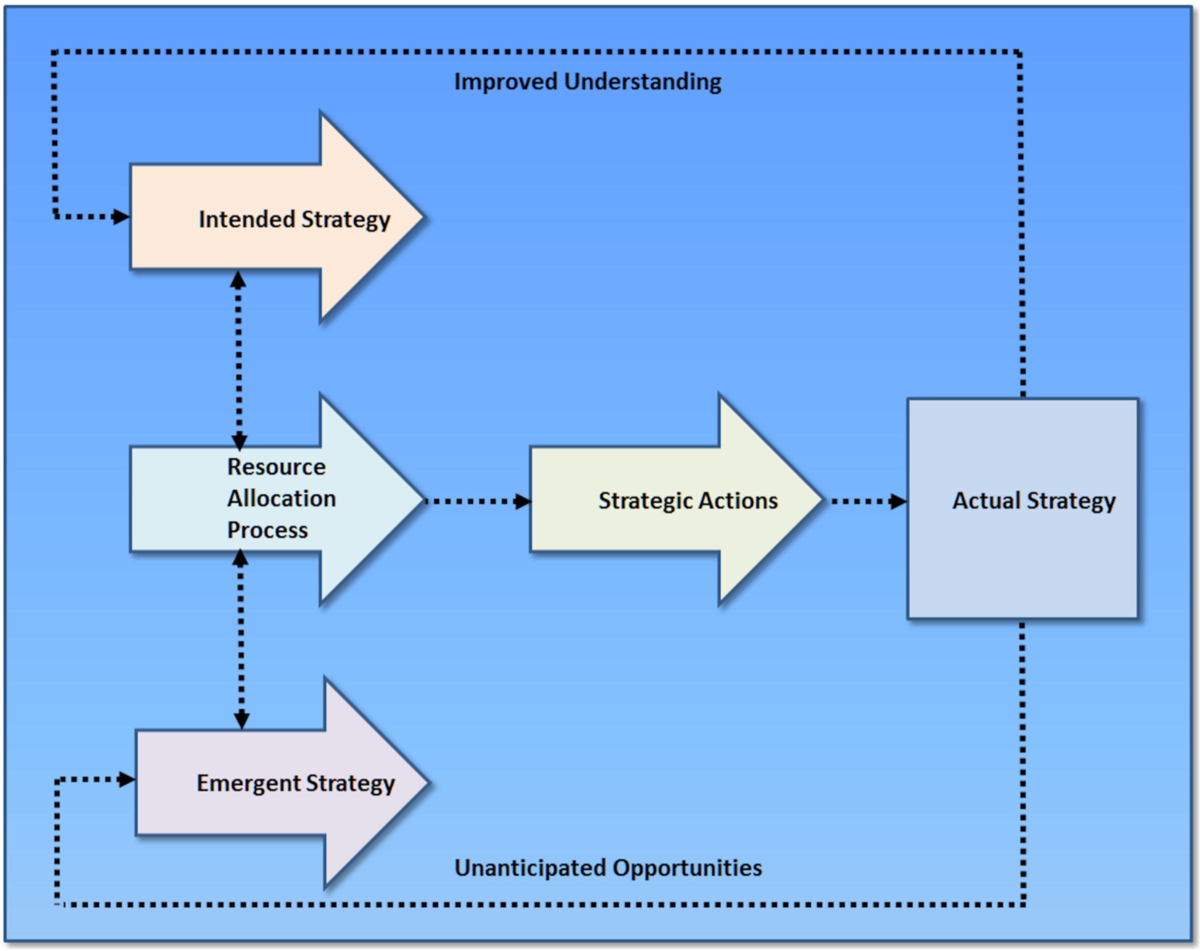


Figure 47: Actual Strategy. *Source: (Taslak, 2004)*

6.1. Strategic Management Tools

Strategic management can be defined as the art and science of formulating, implementing, and evaluating cross-functional decisions that enable an organisation to achieve its objective. Strategic management therefore, focuses on integrating management, marketing, finance/accounting, production/operations, research and development, and computer systems in order to achieve organisational success (Lisiński and Šaruckij, 2006). Strategic planning methods form an extensively developed and interrelated group of dozens of methods used for organisation strategy development. The significance of using methods to increase a given company's competitive advantage is growing, because of the changing needs to create and use the organisation's strategic development. Intuitive or routine ways of problem solving with methods used up until now turned out to be fallible or ineffective (Lisiński, 2004), and research has confirmed that only a small amount of firms use strategic planning methods in practice due to different reasons (David, 2011a). There are a number of strategic management tools, at the disposal of management which can be utilised when undertaking the task of strategic analysis. Among them are; the Boston Consulting Group (BCG) methodology, Strength, Weakness, Opportunities, and Threats (SWOT) analysis, and the Grand Strategy Matrix (GSM), to name but a few. Although SWOT analysis is one of the most common techniques that are used for situational analysis within many organisations, the results of SWOT analysis, are largely descriptive. The matrix contains a listing of organisational strengths, weaknesses, opportunities, and threats that are usually the outputs emanating from brainstorming sessions. Traditionally, a SWOT analysis matrix is not analysed in a systematic or formal manner, with a view to developing strategies for increasing the organisation's efficiency or performance. Having considered these issues and the problems associated with a number of these techniques, the management team at PDV decided that the SPACE matrix represented a methodology that was more suitable to their purpose. The steps required to develop a SPACE matrix are as follows:

- Select a set of variables related to; financial strength, competitive advantage, environmental stability, and industry strength.
- Assign a numerical value ranging from +1 (worst) to +6 (best) to each of the variables that make up the financial strength and industry strength dimensions. Assign a numerical value ranging from -1 (best) to -6 (worst) to each of the variables that make up the environmental stability and competitive advantage dimensions.
- Compute an average score and dividing by the number of variables.
- Plot the average scores in the SPACE Matrix.
- Add the two scores on the x-axis and plot the resultant point on X. Add the two scores on the y-axis and plot the resultant point on Y. Plot the intersection of the new x y point.
- Add the two scores on the x-axis and plot the resultant point on X. Add the two scores on the y-axis and plot the resultant point on Y. Plot the intersection of the new x y point.
- Draw a directional vector from the origin of the SPACE Matrix through the new intersection point.

The resulting vector reveals the type of strategies recommended for the organisation: aggressive, competitive, defensive, or conservative. A plot obtained from performing this procedure, in a particular instance is illustrated in Figure 48. Examples of four distinct different types of strategic profiles, which can be obtained from using this methodology, are illustrated in the following diagrams. The directional vector associated with each profile suggests the type of strategies which are the most productive for the organisation to pursue: Aggressive, Conservative, Defensive, or Competitive.

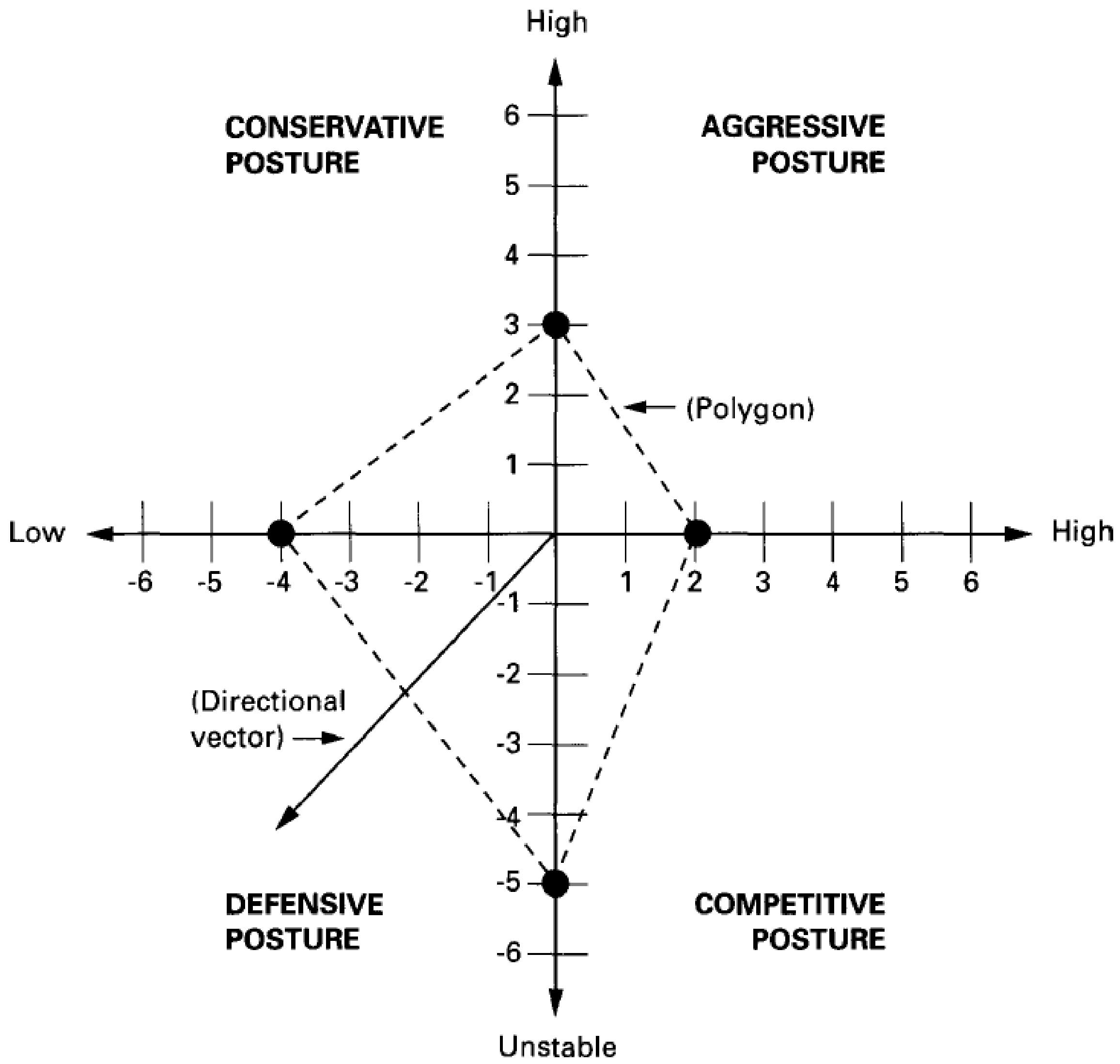
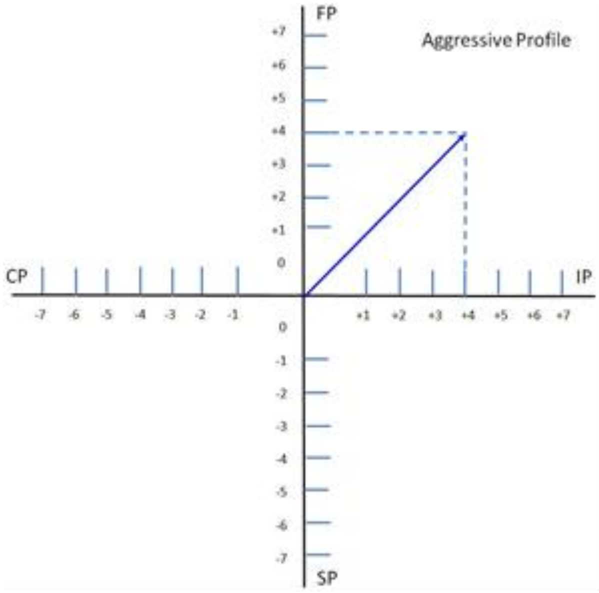
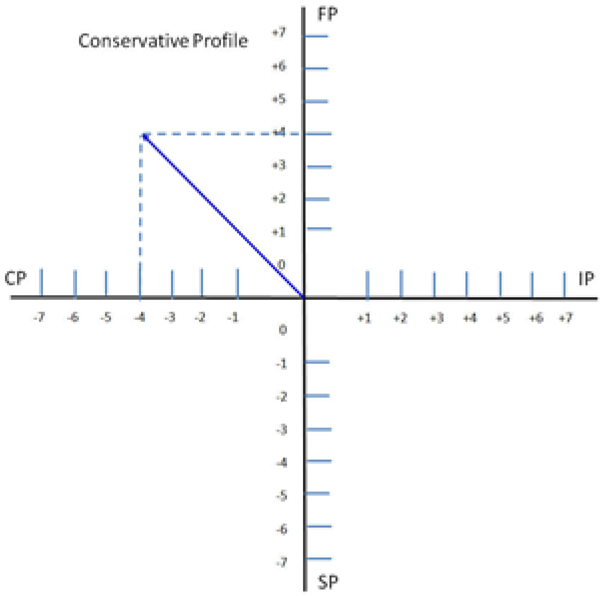


Figure 48: The SPACE Matrix. *Source: (Radder and Louw, 1998)*

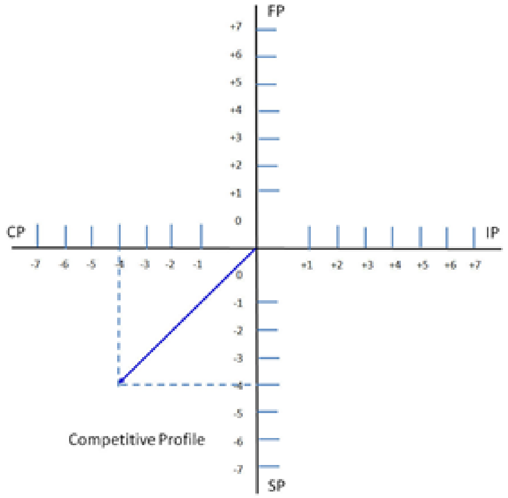
When the directional vector is located in the upper right hand quadrant of the SPACE Matrix, this indicates that the organisation is well positioned in terms of its strategic capabilities, to take advantage of; its internal strengths, external opportunities, overcome internal weaknesses, and avoid external threats. This gives the organisation the ability to pursue market penetration, market development, product development, or a number of diversification or integration strategies.



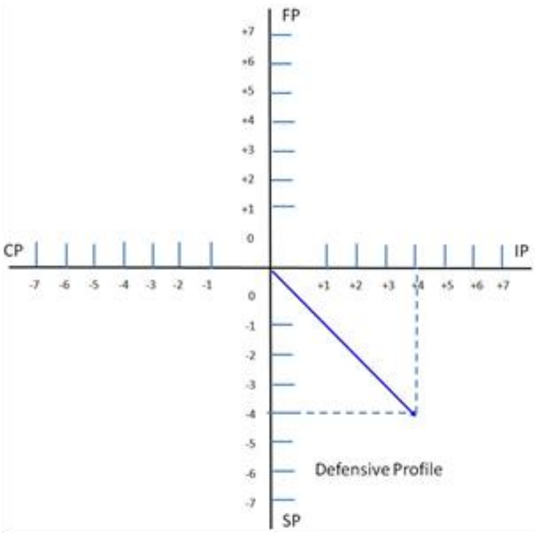
When the directional vector is located within the upper-left quadrant of the SPACE Matrix, this is an indicator that there are weaknesses within the organisation's competitive strategy and that the organisation should leverage its core competencies, and avoid taking too many risks. Basically a policy of *"Stick at what you know best"* should be adopted. Conservative strategies include, market penetration, market development, product development, and concentric diversification.



When the directional vector is located in the lower-left quadrant of the SPACE Matrix, this indicates that the organisation is suffering from both competitive and strategic weaknesses. The organisation should therefore focus on rectifying internal weaknesses and avoid, where possible any external threats. Defensive strategies include retrenchment, divestiture, liquidation, and concentric diversification.



When the directional vector is located in the lower-right quadrant of the SPACE Matrix, this indicates that the organisation is well positioned in terms of its industrial position. However, its strategic position is weak. The organisation therefore needs to consider strategies that will include backward, forward, and horizontal integration; market penetration; market development; product development; and joint ventures.



Management within PDV appointed a team comprised from key personnel within the organisation, whose primary task, was to establish the strategic and competitive position of PDV within the SPACE matrix. One of the first tasks for the team was to ascertain the key factors which would be included in each dimension. In order to keep the matrix meaningful and to avoid including trivial items, it was decided to set a target of ten key factors within each dimension. The key factors which were determined to be significant within the Stability Position (SP) included; technological change, rate of inflation, demand variability, price range of competing products, barriers to entry into the market, competitive pressure, and price elasticity of demand. Factors determining the Industry Position (IP) included; growth and profit potential, financial stability, technological know-how, resource utilisation, capital intensity, ease of entry into the market, and productivity or capacity utilisation. Critical factors within the Competitive Position (CP) included; market share, product quality, product life cycles, and product replacement cycles. Other factors included; customer loyalty, competition's capacity utilisation, technological knowhow and vertical integration. Factors which influence the Financial Position (FP) include; return on investment, leverage, liquidity, capital required/available, the ease of exit from the market, and the risks involved in the business. Utilising the combined knowledge-base of the team members, each factor within the matrix was assigned a value, between zero and six. The figures obtained from this analysis are included in Table 7. The averages for each group of factors, was then plotted on the SPACE chart. By connecting the average values plotted, a four-sided polygon displaying the weight and direction of the particular assessment was then constructed. The strategic position was determined by adding the two scores on the axes opposite each other to obtain a directional vector that, points to a specific location in the chart, as illustrated in Figure 49.

Factors determining Financial Position										
Return on investment	Low	0	1	2	3	4	5	6	High	4
Leverage	Imbalance	0	1	2	3	4	5	6	Balanced	5
Liquidity	Imbalance	0	1	2	3	4	5	6	Balanced	4
Capital required/capital available	High	0	1	2	3	4	5	6	Low	3
Cash flow	Low	0	1	2	3	4	5	6	High	4
Inventory Turnover	Low	0	1	2	3	4	5	6	High	5
Earnings Per Share	Low	0	1	2	3	4	5	6	High	5
Price Earnings Ratio	Low	0	1	2	3	4	5	6	High	4
Ease of exit from market	Difficult	0	1	2	3	4	5	6	Easy	5
Risk involved in business	Little	0	1	2	3	4	5	6	Much	3
	Average									**4.20**
Factors determining Stability Position										
Technological changes	Many	0	-1	-2	-3	-4	-5	-6	Few	-2
Rate of inflation	Low	0	-1	-2	-3	-4	-5	-6	High	-2
Demand variability	Small	0	-1	-2	-3	-4	-5	-6	Large	-2
Price range of competing products	Narrow	0	-1	-2	-3	-4	-5	-6	Wide	-1
Barriers to entry into market	Many	0	-1	-2	-3	-4	-5	-6	Few	-3
Competitive pressure	Low	0	-1	-2	-3	-4	-5	-6	High	-1
Price elasticity of demand	Unelastic	0	-1	-2	-3	-4	-5	-6	Elastic	-3
Risk involved in Business	Low	0	-1	-2	-3	-4	-5	-6	High	-2
Ease of Exit from Market	Easy	0	-1	-2	-3	-4	-5	-6	Difficult	-2
	Average									**-2.00**
Factors determining Industry Position										
Growth potential	Low	0	1	2	3	4	5	6	High	1
Profit potential	Low	0	1	2	3	4	5	6	High	4
Financial stability	Low	0	1	2	3	4	5	6	High	3
Technological know-how	Simple	0	1	2	3	4	5	6	Complex	1
Resource utilization	Inefficient	0	1	2	3	4	5	6	Efficient	2
Capital intensity	High	0	1	2	3	4	5	6	Low	3
Ease of entry into market	Easy	0	1	2	3	4	5	6	Difficult	2
Productivity/capacity utilization	Low	0	1	2	3	4	5	6	High	2
Flexibility, adaptability	Low	0	1	2	3	4	5	6	High	1
Extent Leveraged	Low	0	1	2	3	4	5	6	High	2
	Average									**2.10**
Factors determining Competitive Position										
Market share	Large	0	-1	-2	-3	-4	-5	-6	Small	2
Product quality	Superior	0	-1	-2	-3	-4	-5	-6	Inferior	3
Product life cycle	Early	0	-1	-2	-3	-4	-5	-6	Late	3
Product replacement cycle	Fixed	0	-1	-2	-3	-4	-5	-6	Variable	3
Customer loyalty	High	0	-1	-2	-3	-4	-5	-6	Low	1
Competition's capacity	High	0	-1	-2	-3	-4	-5	-6	Low	3
Technological know-how	High	0	-1	-2	-3	-4	-5	-6	Low	2
Vertical integration	High	0	-1	-2	-3	-4	-5	-6	Low	2
Control over Suppliers and Distributors	High	0	-1	-2	-3	-4	-5	-6	Low	3
	Average									**2.44**

Table 7: PDV SPACE Matrix Analysis

The vector obtained as a result of performing the analysis, indicated that PDV occupied a conservative position within the SPACE matrix. Although the analysis demonstrated that PDV were in a relatively good position with respect to the financial aspects of the business, it clearly demonstrated that the business was not growing, or achieving its potential, within a relatively stable market place. This pointed to the need for a much stronger focus in relation to product competitiveness, and the necessity to gain entry into more attractive markets. A short analysis of each factor that contributed to the final vector position is provided below.

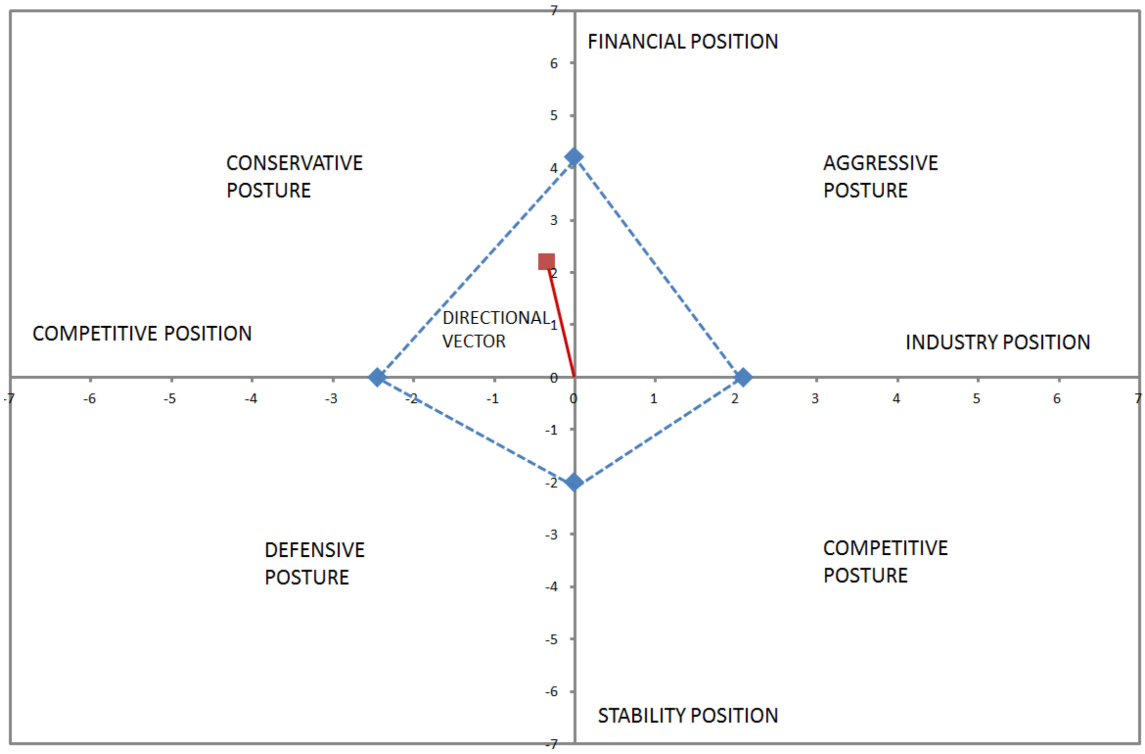


Figure 49: SPACE Matrix analysis of PDV

The Financial Position: A very healthy financial position within PDV was indicated by the FP score of 4.2. The key factors within this dimension are; difficulty of exit from the market, high capital required, and capital availability, moderate return on investment, as well as balanced financial leverage and liquidity. The large capital outlay required to establish a presence within this sector, acts as a barrier to entry into the market and further results in a high commitment when considering entry into the industry. This also implies a level of difficulty when exiting from the sector, as assets cannot be sold easily. PDV also became aware through this analysis, that they could be bought out, or acquired through acquisition by larger players within the marketplace.

The Stability Position: The score obtained for this dimension was -2.0. The overall environment in which PDV operates is relatively stable. The critical factors which dominate this dimension within this sector are; high competitive pressure, high rate of inflation, a number of barriers to entry, and high price elasticity of demand. The industry segment is highly competitive, indicating that the market is well covered by rival organisations. This in turn makes it more difficult for new entrants to break into the sector, because of the relatively high capital outlays required, and the extent to which competition already exists within the sector. Consumers within this sector are very price conscious which constrains margins across the product range.

The Competitive Position: It can be observed that from the factor rating of -2.4 that PDV does not have a very strong competitive advantage within the sector. The distinguishing factors contributing to competitiveness include; good product quality, technological know-how, moderate competitor capacity utilisation, and high market share. This particular finding was a key indicator to PDV that it urgently needed to address IT technological challenges within the organisation, if it did not wish to see its competitive position being eroded further.

The industry Position: The score for industry strength was 2.0. Although PDV were operating in relatively stable sector, they were utilising relatively antiquated systems within its technology divisions throughout the organisation. The FP factor analysis, demonstrated that PDV were in a relatively healthy financial position, which provided it with the ability to invest in IT technology programmes, which would be essential for maintaining market leadership in the industry segment.

6.2. Business Architecture

An organisation is a living entity, and over time aspects of the organisation will change, such as the products they produce, the customers they serve, and the technologies utilised, and in the case of technology, the rate of change tends to accelerate over time. In order to cope effectively with the level of change involved, managers have sought out models that will not only allow them to understand how business and IT within their organisation align to achieve strategic objectives, but also how to work in a way that positively promotes these objectives. All technologies, including companies, have an architecture, which consist of a function and structure of elements to carry out that function (Arthur, 2009). A company consists of the technological elements management, organisation, business, fulfilment, and offerings. Explicitly representing this architecture helps to understand it, develop it, refine it, add new functions, employ it, and upgrade it whenever needed, by replacing a component. According to (Korn and Pine II, 2010), business enterprise and company management should encompass the following points:

- Dealing with all of humanity, as people permeate all elements of business as employees, as customers, as citizens in society, and as economic actors.
- Creating customers by being of value to them.
- Providing offerings to generate that value.
- Executing fulfilment processes to create the offerings.
- Developing businesses to create and capture economic value for the company.
- Organising all the resources of the company.
- Guiding the company to engage and compete in its ecosystem.
- Participating in one or more economies.
- Managing all of the above to build a company capable of achieving persistent advantage.

These factors define the nine fundamental elements of business architecture shown in Figure 50.

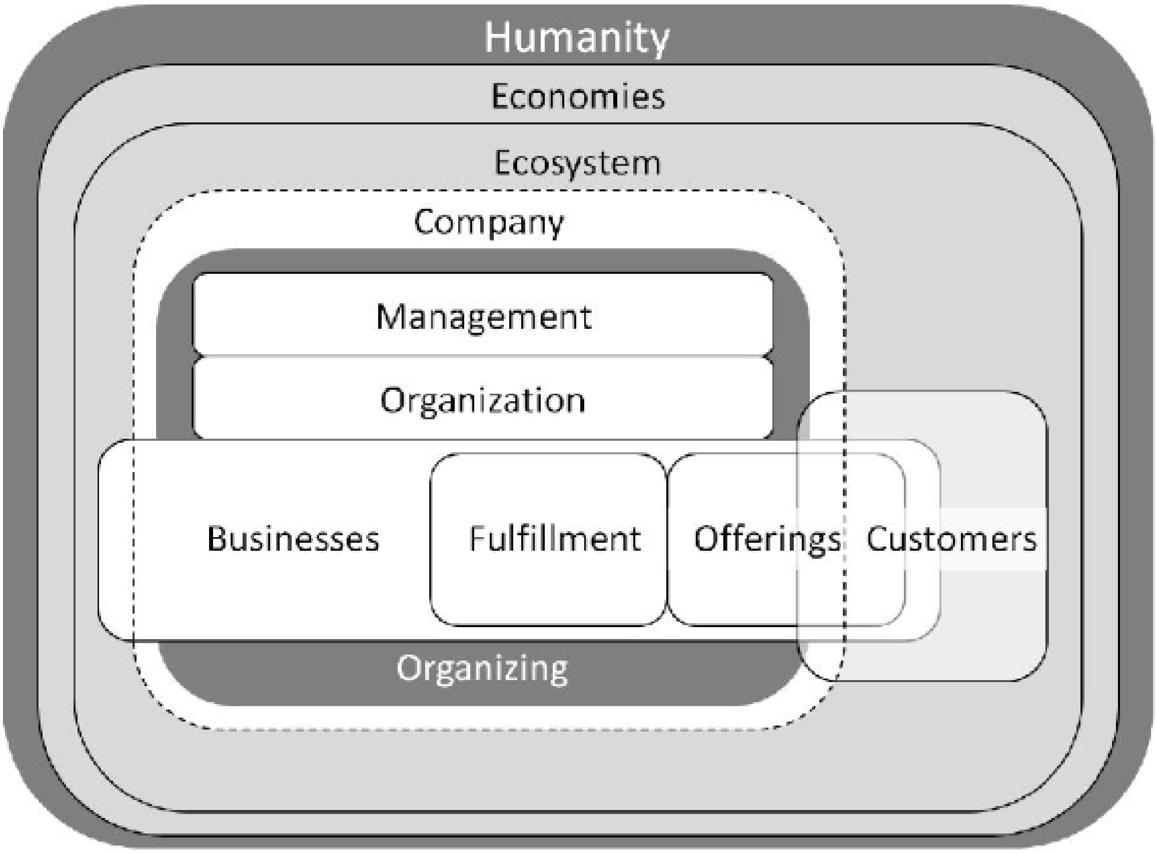


Figure 50: Fundamental elements of Business Architecture. *Source: (Korn and Pine II, 2010)*

Business Architecture represents a methodology that can be used to enable the organisation to plan for progression. It’s a model that includes the current and future business objectives, goals, visions, strategies, informational entities, business processes, people, organisational structures, application systems, and technological infrastructures (Pereira and Sousa, 2005). A major challenge that confronts business managers is that of evaluating and assessing the extent to which investments within their organisations are making, and to what extent are they contributing to strategic realisation. Resources are being utilised, and everyone has the shoulder to the wheel, but will it make a difference? While most managers have a good idea of what they want their organisations to achieve, they can sometimes struggle to translate their vision into focused and effective action. Most executives see their role as creating and communicating corporate strategy, but they then leave the act of implementation to others. They tend to be of the opinion that once a strategy is defined, the organisation will automatically rally behind it, understand what needs to be undertaken, and execute the necessary steps to bring the strategy to fruition however, this is rarely the case.

As strategies move down and across organisational boundaries they become distorted, resulting in diluted business impact and wasted resources. As the strategic message diffuses downwards, lower level managers may translate the strategy to fit his or her vision, accountabilities and view of the world, which they then interpret to fit their own interests. This loss of strategy fidelity increases as the strategy moves through the organisation, which can greatly diminish the clarity of the original intent. A methodology that can be employed to surmount this type of difficulty is to have a well-articulated strategy that is clearly illuminated across the organisation and managed on a day-to-day basis. When everyone has the same understanding of the strategy, not just the goals, this can result in a situation whereby activities become synergised and productivity improves dramatically, and the whole becomes greater than the sum of its parts. This requirement to maintain strategic fidelity throughout the organisation can best be fulfilled by *a "Business Architect"* whose role is to structure the enterprise in terms of its governance structure, business processes, and business information. The mission that this person is charged with, is to align the strategic goals and objectives of the organisation with key business and IT initiatives. The primary focus within this context, are issues relating to the business objectives and motivation, business operations, business analysis frameworks, and other related networks that link all of these aspects of the enterprise together.

The Business Architect works to develop an integrated view of the enterprise using a repeatable approach, cohesive framework, and available industry standard techniques. Business architecture has been defined as *"A formalised description of how an organisation uses business competencies essential to realising strategic intent and objectives"*, and it represents a methodology that can be used to relate the goals and visions of an organisation to the operations that the organisation performs. According to (Hendrickx et al., 2011), Business Architecture embraces abstract concepts, often arising from the contextual situation and corporate strategies, and relates them to their operational realisations as its practice. Because of the breadth of available representations and perspectives, the variations around how an organisation's business architecture is uniquely expressed and realised will be, in no small part, due to its culture and its ability and preferences around how to adapt and govern this business description. A correctly designed, business architecture has the ability to translate the business intentions into the structure of operations that is adaptable throughout the organisation. The specific aspect of the Business Architect is to gain a holistic understanding of the business direction, context and strategies and then to describe and communicate this understanding using different forms, in a consistent way across all layers of effort, to all the various stakeholders. Their activities typically contribute to strategy execution through development of transformation approach, programme planning or project initiation phases (Hendrickx et al., 2011). To succeed, Business Architecture must be pragmatic and, to be sustainable, it must focus on achieving long-term value while, at the same time, recognising the shorter-term tactical needs of the organisation.

A well designed business architecture provides the ability to leverage business knowledge, provides value for IT initiatives and ensures alignment of architecture to strategy and objectives by connecting the diverse business facets into a single whole, which defines what the business accomplishes, who makes it happen, how it is done, where and when it takes place (Carter, 2008). The building blocks of the business architecture are data, people, function and rules organised by location and timing. A study which informs in relation to this subject area was conducted by (Versteeg and Bouwman, 2006). This was centred upon a large, internationally operating financial service provider, where mergers and acquisitions led to a growing collection of organisations that operated largely independently under an umbrella of financial consolidation, but without genuine operational integration. The reason that the company needed to develop a business architecture, was due to the problems that arose when the information architecture that had earlier been developed for a limited number of business units, needed to be implemented on an enterprise-wide basis. In order to address this problem thoroughly, the company decided to first develop an enterprise-wide business architecture that was acceptable to all parties concerned and then translate its consequences into information architecture. The methodology utilised was as follows:

- Setting up the basic design.
- Extrapolating the basic design.
- Setting up extended design.
- Assessment of the extended design.
- Adoption of the business architecture.

From this study, it was found that designing a business architecture helped to clarify the relationship between the strategy of an organisation and the way it is organised, both in terms of business processes, business domains, and business functions. The business architecture provided a far sturdier framework to design the organisation than individual strategic statements that lack structure, coherence and balance. This made it simpler to validate the subsequent enterprise-wide information architecture. In addition, business architecture helped to shed light on the structure of, and overlap between various business domains, making it possible to identify the value chain within the organisation more clearly and to re-assign responsibilities within the organisation accordingly. Furthermore, this helped to distinguish activities within the organisation related to technical support by IT, production-related and commercial activities and management activities. The creation of the business architecture provides the business with a tool to influence the subsequent IT architecture, which also has the effect of assisting IT with a more involved business that has formulated and structured their business requirements, which clearly demonstrates that having business architecture benefits both parties, business as well as IT.

In the type of classic model represented in this case, the Business Architect creates a blueprint that represents the business executives and managers viewpoints. This provides the basis for more detailed designs and other organisational planning. Information, applications, security and privacy, policy and rules, and technology architectures, each contribute to the design of required IT solutions associated with organisational change. The design is focused on business process modelling and management. Throughout the design process, architects help to illustrate possible innovation opportunities arising from the world of technology and how these opportunities contribute to business objectives. The primary design provides an overall definition of major business domains. The choices made are extrapolated consistently into a design based on general organisational principles and on the lower-level strategy statements (Gromoff et al., 2013). Today the use of Cloud services make a number of new business models possible, that provides for more rapid and responsive systems to provide the information to executives about project deadlines, and the implementation of a new products or services. The application of Cloud services to these types of business functions, provides for the possibility of fruitful results in the future (Stavenko and Gromoff, 2011).

6.3. Governance Structures

Information Technology (IT) governance has emerged as a fundamental business imperative and this is justified, because it is fundamental to realising IT business value. IT governance describes the distribution of IT decision-making rights and responsibilities among different stakeholders in the enterprise, and defines the procedures and mechanisms for making and monitoring strategic IT decisions (Peterson, 2004). Chief executives have experienced many failures and disappointments with IT-enabled business transformations (Luftman and Brier, 1999). Expecting strategic value from innovation, they have instead experienced project cancellations, business disruptions, rising customer churn, decreasing shareholder value, and many other disappointments, including losing their jobs (Sambamurthy and Zmud, 1999). In previous studies conducted by (Weill, 2004), among others, IT governance has been defined as: *"The distribution of IT decision-making rights and responsibilities among enterprise stakeholders, and the procedures and mechanisms for making and monitoring strategic decisions regarding IT"*. A critical role for governance, is to monitor and control the behaviour of management, who are hired to preside over the day-to-day activities of running the organisation (Eisenhardt, 1989, Fama and Jensen, 1983). The critical role of IT in enterprises has led to the view that IT governance must be managed to support or enable business objectives and mitigate risks associated with IT implementation (Trites, 2004). IT strategic planning has received growing emphasis and is a major component of IT governance (S. Hamaker, 2004), which can be seen as a holistic strategic, controlling framework for effective and efficient use of IT.

A significant fact in relation to IT governance, is that it does not describe what specific IT decisions are made; rather, IT governance is the set of decisions about who makes IT decisions (Weill, 2004), and how it specifies the structures and processes through which the organisation's IT objectives are set, and the means of attaining those objectives and monitoring performance. A study undertaken by (Bernroider, 2008), to view ERP success in the usage stage after its implementation focused on the direct link between managerial practices and ERP value. Important social actors of this stage are; end users, technical administration, and business and IT management personnel. In this study Bernroider, hypothesised that ERP success increased with implementation of key IT governance practices. More specifically, the considered practices comprised of the employment of an IT/IS strategy; the achievement of strategic alignment; the development of a selection goal hierarchy based on fundamental strategic objectives; management commitment to the whole project; and the installation of a participative form of decision making and implementation that included all major stakeholders. He went on to propose the following hypotheses:

- Hypothesis A: ERP success increases if firms have an explicitly defined IT/IS strategy.
- Hypothesis B: ERP success increases if companies pursue strategic alignment.
- Hypothesis C: ERP success increases if a strategic concept drives ERP evaluation.
- Hypothesis D: ERP success increases with top management commitment to the whole project.
- Hypothesis E: ERP success increases if a participative form of decision-making is employed.
- Hypothesis F: ERP success decreases if the project team is dominated by business management.

Within the study, two hundred and nine valid returns were registered from both Small to Medium Organisations (SMEs) and Large Enterprises (LEs), resulting in an above-average response rate of 22 per cent.

The results of the study indicated the following results:

- Hypothesis A: ERP success increases if firms have an explicitly defined IT/IS strategy: Generally supported.
- Hypothesis B: ERP success increases if companies pursue strategic alignment: Partially indicated for SMEs only.
- Hypothesis C: ERP success increases if a strategic concept drives ERP evaluation: Generally indicated.
- Hypothesis D: ERP success increases with top management commitment to the whole project: Supported for LEs only.
- Hypothesis E: ERP success increases if a participative form of decision-making is employed: Generally supported.
- Hypothesis F: ERP success decreases if the project team is dominated by business management: Generally supported.

Overall, the results of the study support the fact that the application of IT governance key practices is positively related to ERP value delivery. Strategic guidance in the ERP selection process was observed in about 67 per cent of the companies. However, the IT/IS strategy is in general explicitly defined only for a minority of companies, and strategic alignment takes place at an indifferent middle management level. This indicates that ERP was often selected for technical or integration factors rather than strategic business reasons. LEs relied more on ERP project teams with participative, group support, while SMEs utilised a more central business management oriented team. The need for management commitment to the ERP project was not pronounced for all companies. Management commitment seemed to be critical only in large enterprises while business management in SMEs is concerned with any project as large as that of ERP. This demonstrates that an effective IT governance mechanism seems to facilitate ERP success rates (Bernroider, 2008).

6.4. Financial Analysis

The SPACE matrix was not the only analysis tool, or source of information that PDV was using to inform its strategic thinking. Of particular concern to senior management within PDV, were the signals emanating from within the financial and accounting departments. Financial analysis is the process of evaluating businesses, projects, budgets and other finance-related entities to determine their suitability for investment. It is normally used to analyse whether a financial entity, such as an organisation or institute is stable, liquid, solvent, or profitable enough to be invested in. When looking at a specific company, the financial analyst will often focus on the income statement, balance sheet, and cash flow statement. In addition, one key area of financial analysis involves extrapolating the company's past performance into an estimate of the company's future performance. This is of key importance when an organisation is considering a change of direction, an expansion plan, or is considering investing in new technology as part of a reengineering programme. One of the most common ways of analysing financial data is to calculate ratios from the data to compare against those of other companies or against the company's own historical performance. Return on assets is a ratio that is used to determine how efficient a company is at using its assets, and as a measure of profitability. Traditional accounting systems were developed more than a century ago, with the development of more advanced product manufacturing processes a new system was called for that would allow managers to track costs and analyse them accordingly to the cost factors. The Activity-Based Costing (ABC) system was introduced in the 1980s, and was considered to be a break-through by many managers. Like many other organisations, PDV had adopted the ABC system for use in their financial department. One of the main benefits to be derived from the ABC system is that it can be applied across the various functions within the organisation. It provides the ability to link the performance of activities and the demand those activities make on the organisation's resources. In this way it provides management with a clear picture of how products, brands, customers, facilities, regions, or distribution channels both generate revenues and, consumes resources. The ABC analysis plays a key role in assisting managers in focusing their attention and energy on improving activities that will have the biggest impact on the bottom line. Within the accounting system, financial ratios provide useful indicators of the firm's performance and financial situation. Most ratios can be calculated from information provided by the financial statements. Financial ratios can be used to analyse trends and to compare the firm's financials to those of other firms. Careful analysis of the ratios can allow an organisation to predict future performance, including possible bankruptcy. Financial ratios can be classified according to the information they provide. The following types of ratios are frequently used:

- Liquidity ratios.
- Asset turnover ratios.
- Financial leverage ratios.
- Profitability ratios.
- Dividend policy ratios.

Within the margin profitability analysis, the Gross Margin and the Return on Assets (ROA) are of particular interest. These are the ratios that the company uses to determine the profits over a certain period of time, along with a measure of how profitably assets are being utilised. The gross margin is the amount that is derived from subtracting the cost of goods sold from the net profit. The amount that is left is the gross margin. It can be expressed as:

$$\text{GROSS MARGIN} = \frac{\text{SALES} - \text{COST OF GOODS SOLD}}{\text{SALES}}$$

The ROA is calculated, by simply dividing the net income by total equity. The chart illustrating both of these measures for PDV, for the five years prior to the ERP/BI initiatives is illustrated in Figure 51. Within neither measure, did the chart represent a pretty picture. It was very obvious from the observed trends, that if some kind of corrective measures were not taken within a timely fashion, than the long term prognosis for the organisation did not auger well. It was the combination of the results emanating from both the SPACE analysis and the financial ratios, which provided the impetus for a change in direction.

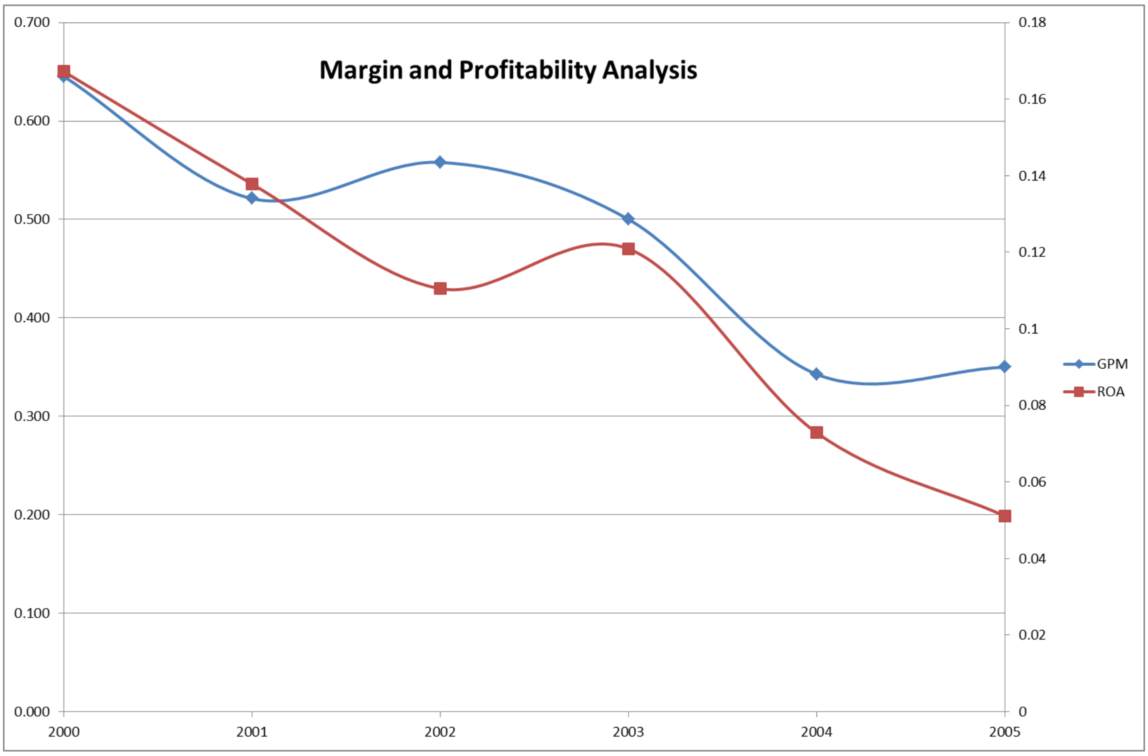


Figure 51: PDV Margin and Profitability Analysis

It is a curious fact which has been noted within the literature, that the factors which combine to bring organisations to the point of success are unable to maintain that same success, over the long term. Recent empirical studies have convincingly demonstrated a consistent pattern of results with respect to the management of innovation. In almost every industry studied, a set of leading firms faced with a period of discontinuous change fails to maintain its industry's market leadership in the new technological era. In research conducted by (Tushman and O'Reilly, 2002), they confirm this point in which they describe how W.E. Deming originally highlighted this theme, among a broad and diverse range of industries. Deming made the point, that many well established organisations which had achieved market dominance, were unable to maintain that position, and (Tushman and O'Reilly, 2002) described this as a pathological trend which has been described as *"The Tyranny of Success"* in which winners often become losers, and firms lose their innovative edge, and this has been acknowledged as a worldwide phenomenon. At one time IBM ruled supreme within the main frame computer market, but they failed to gain dominance within the minicomputer market, which represented a simpler technology. Another organisation which dominated within minicomputers Digital Equipment missed the P.C. market completely. Although Apple is now recognised as a world leader in innovation, it struggled for many years in trying to bring its portable P.C. to the market place. In more recent times, Yahoo, once a dominant player in

Internet technologies, and which billed itself as the number one Internet brand globally, is now really struggling to maintain its market position in the face of stiff competition within the marketplace. Similarly Nokia, a name which is synonymous with the mobile phone, is finding it very difficult to compete at the upper end of the market, a position that Apple now dominates. The factors that brought Apple so much success were closely associated with the personality and style of Steve Jobs, who many regarded as a true visionary within the industry, although not everyone shared this viewpoint. It will be interesting to see if Apple can maintain this dominance with the new CEO Tim Cook.

6.5. Gartner Hype Cycle

It seems that the very factors that lead to a firm's success can also play a significant role in its demise. The leadership, vision, strategic focus, valued competencies, structures, policies, rewards, and corporate culture that were all so critical in building the company's growth and competitive advantage during one period can become its Achilles heel as technological and market conditions change over time (Paap and Katz, 2004). In order to avoid many of these issues, organisations are now concentrating their efforts on anticipating *"disruptive technologies*," new technologies that may affect their competitive position. The term *"disruptive technology"* was introduced by Bower (Bower and Christensen, 1995), and it reflects a reality that many managers must face within the modern business environment. It can indeed be difficult for management to decide which route to adopt when confronted with such decisions. A tool that the management at PDV found to be useful in this regard was one which was developed by Gartner, and is referred to as the *"Gartner Hype Cycle"*. There are several life cycle models which attempt to gauge the evolution of a technology. The two most popular are the performance S-curve, which shows the increase in a technology's performance over time, and the adoption curve, which shows market adoption over time. The Hype Cycle has the benefit of adding another dimension to these models. In addition to charting technology maturity, Hype Cycles also reflect human attitudes to technology. Most technologies conform to the Hype Cycle. In this model, people represent the stable component of the equation and not the technology. The observation is made by (Fosdick, 1993), that hype precedes maturity within the technological life-cycle. An illustration of the phases of the Hype Cycle is provided in Figure 52.

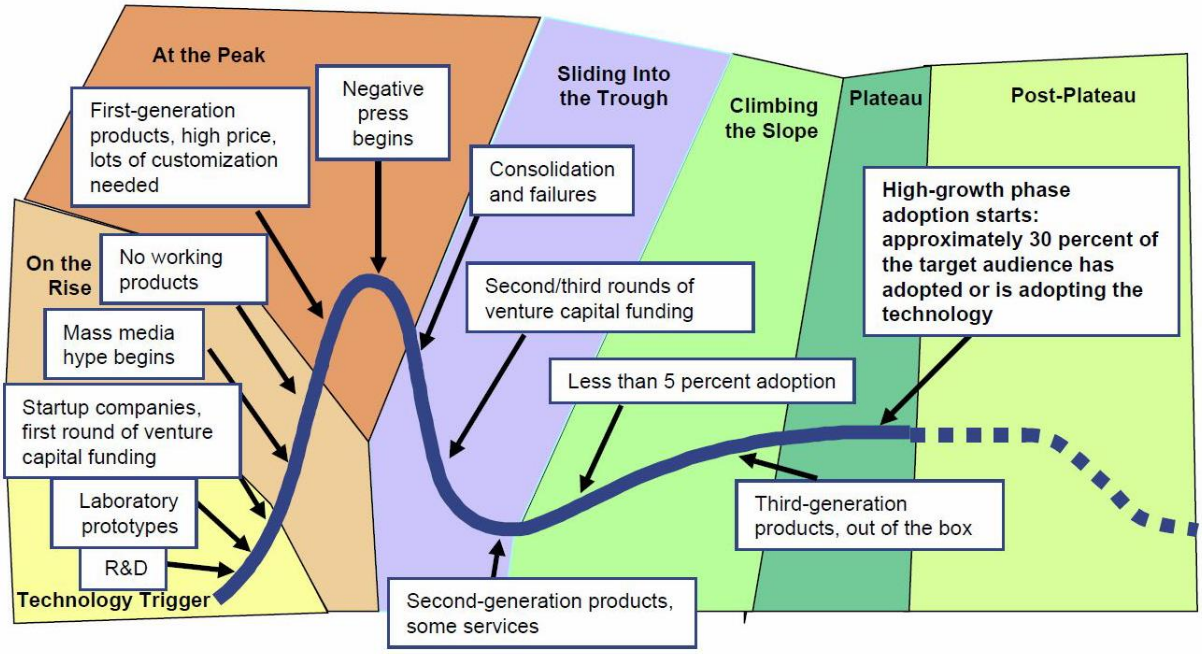


Figure 52: Phases of the Gartner Hype-Cycle. *Source: (O'Leary, 2008)*

A brief description of each phase is as follows:

The Technology Trigger; this represents the technological breakthrough, and, an awareness of the new technology is provided by public demonstration, press release or other events that generate significant publicity and industry interest in an emerging technology. In recent years, one of the masters of this type of event was Steve Jobs of Apple, who used widely publicised and reported events, to assist in the launching of newly emergent technologies. On the rise to the *"Peak of Inflated Expectations*"; in this phase, media articles explain the technology and discuss its potential impact on business and society. Margins tend to be high within this phase, because vendors need to recover R&D costs, and the technology is expensive compared to its cost of production. For example, in 2002, Bluetooth products such as headsets cost 150 Euro, while the final silicon cost of Bluetooth chips is likely to be about 3 Euro. As the Peak crests, the number of vendors offering the technology or variants of the technology increases. This is well illustrated by the number of companies offering variants on products such as the iPhone and the iPad. Sliding Into the *"Trough of Disillusionment": In* situations where the technology does not live up to enterprises' and the media's overinflated expectations, it can become quickly discredited. The *"Trough of Disillusionment"* coincides with the *"chasm"* in Geoffrey Moore's classic book, "*Crossing the Chasm*." The traditional technology life cycle model is normally illustrated by a smooth transition as one, moves between the different groups through the products life cycle. Moore has revised the technology adoption life cycle by dividing each of the groups in the bell curve with divisions between them, illustrating that it takes more effort to move from one group to the next, which is illustrated in Figure 53 below. The division between the early adopters and the early majority is larger than the others, and this is what Moore refers to as the *"chasm"*. The chasm arises, because the needs and perspectives of the early adopters and early majority are very different and the pragmatists are not satisfied with references from visionaries but want them from other pragmatists. Therefore, crossing the chasm is about getting the first footing in the pragmatist segment.

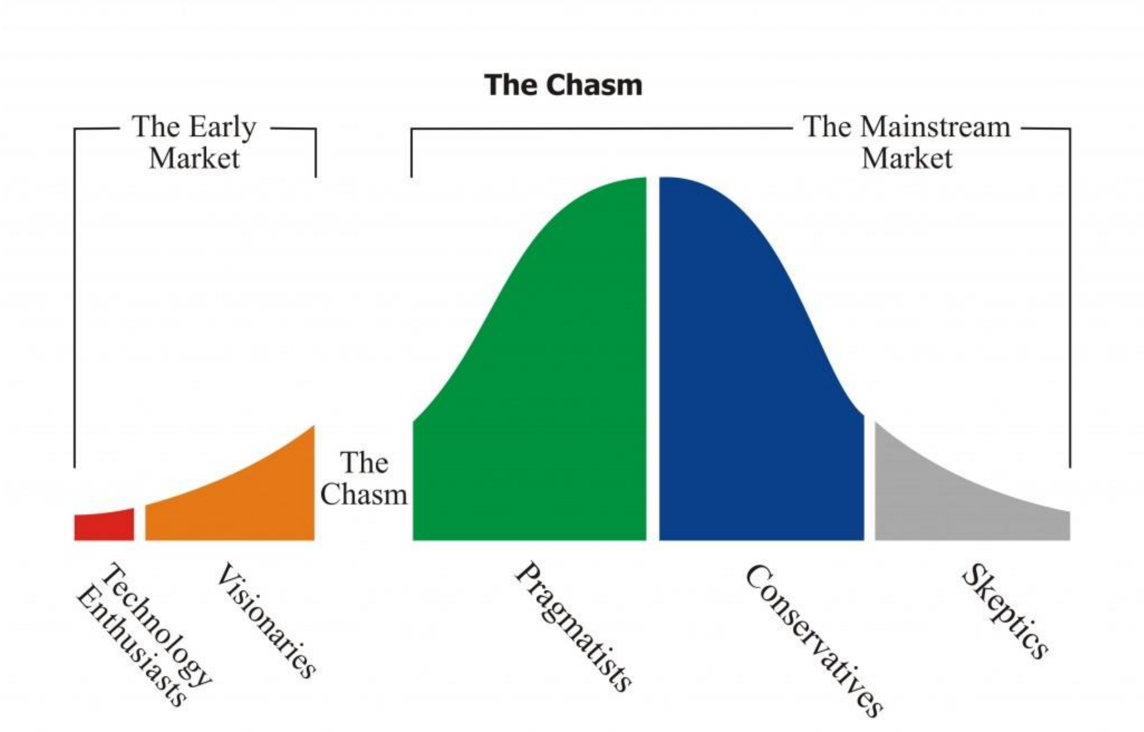


Figure 53: The Chasm. *Source: (Moore, 2002)*

During this stage, vendors need to launch their products from a few early adopters to adoption by a majority of enterprises to begin the climb up the *"Slope of Enlightenment"*. Real-world experience, by an increasingly diverse range of enterprises leads to a better understanding of the technology's applicability, risks and benefits. Second and third generation products are launched, and methodologies and tools are added to ease the development process. Issues relating to service and maintenance, decline as the technology matures and sales increase. The *"Plateau of Productivity";* represents the beginning of mainstream adoption, when the real-world benefits of the technology are demonstrated and accepted. Technologies become increasingly embedded into solutions that increasingly are *"out of the box,"* with decreasing service elements as the technology matures. Figure 54 below illustrates the position of a number of technologies on the Hype Cycle as identified by the Gartner Group.

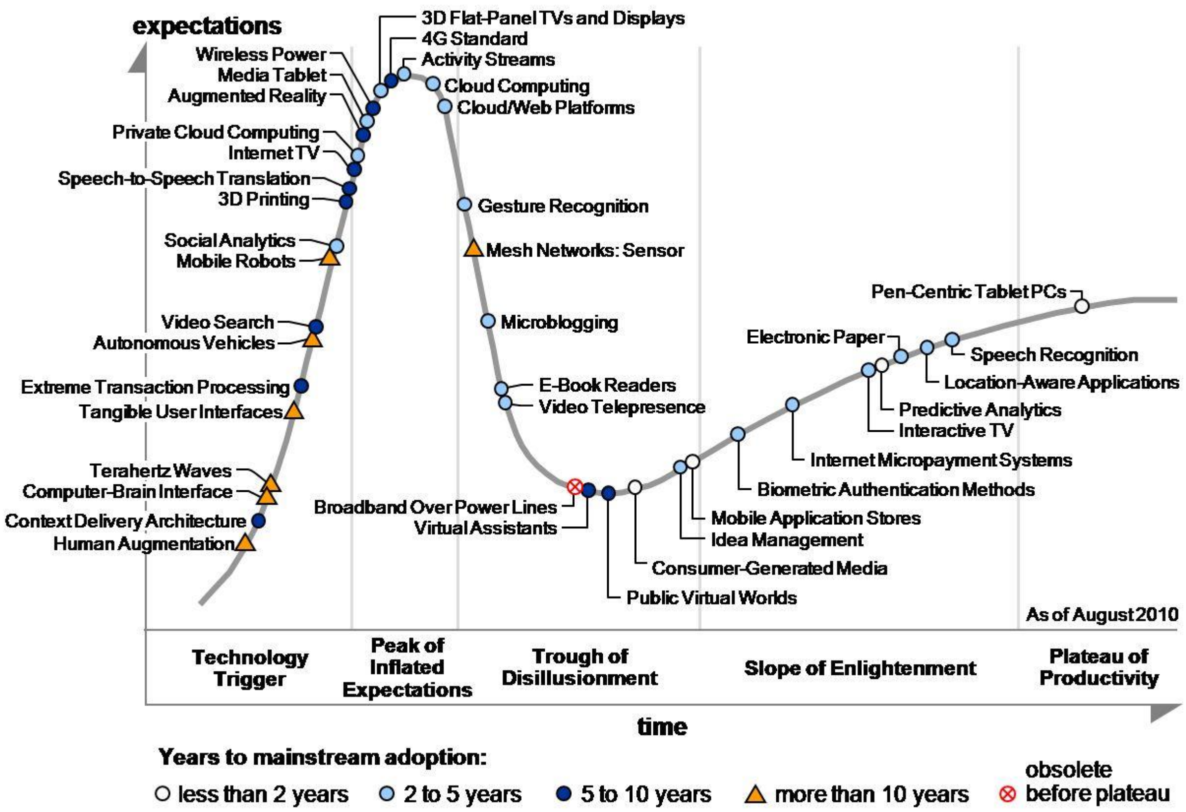


Figure 54: Gartner Group Hype Cycle 2010. Source (Fenn, 2010)

According to the Gartner Group model, social networking technologies, Web mash-ups, multicore and hybrid processors and Cloud computing are amongst the ten most disruptive technologies that will shape the IT landscape over the next five years. Business IT applications will start to reflect the features found in popular consumer social software, such as Facebook and MySpace, as organisations look to improve employee collaboration, and harness the community feedback of customers. Gartner predicts that Web mash-ups, which mix content from publicly available sources, will be the dominant model for the creation of new enterprise applications. Due to the fact that, mash-ups can be created quickly and easily, they create possibilities for a new class of short-term or disposable applications that would normally be difficult to finance. The ability to combine information into a common dashboard or visualise it using geo-location or mapping software is extremely powerful (Cearley *et al.*, 2010). Gartner's listing for the top 10 disruptive technologies for the period 2008 – 2012 are:

- ❖ Multicore and hybrid processors.
- ❖ Virtualisation and fabric computing.
- ❖ Social networks and social software.
- ❖ Cloud computing and Cloud/Web platforms.
- ❖ Web mash-ups.
- ❖ User Interface.
- ❖ Ubiquitous computing.
- ❖ Contextual computing.
- ❖ Augmented reality.
- ❖ Semantics.

Within PDV, senior management indicated that it was very important to be able to utilise as many of these technologies as possible to aid with the strategic progression of the organisation. They therefore, established a team whose mission was to establish a formal mechanism for evaluating emerging trends and technologies. This team was provided with sufficient resources to allow research into new ideas and innovations, especially those that are being driven by consumer and Web 2.0 technologies.

6.6. Social Media

In the new digital economy, where inter-organisational collaboration and innovation are becoming more central to organisational effectiveness, attention must be paid to the relationships that people form, and then utilise while performing their work. Successful information-seeking is a mix of recognising what another person knows, valuing that knowledge, being able to gain timely access to that person, and seeking the information in cost-effective ways (Borgatti and Cross, 2003). Many of these elements are shaped by new IT capabilities and tools. Therefore, the role of IT in shaping social networks is receiving increased attention. Social networking sites enable users to connect by creating personal information profiles, inviting friends and colleagues to have access to those profiles, and sending e-mails and instant messages between each other. These personal profiles can include any type of information, including photos, video, audio files, and blogs. According to Wikipedia, the largest social networking sites are U.S.-based Facebook (initially founded by Mark Zuckerberg to stay in touch with his fellow students from Harvard University), and MySpace (with 1,500 employees and more than 250 million registered users) (Kaplan and Haenlein, 2010). Today, Social Media is playing an increasingly important role within the business environment. There are those who claim that if you do not participate in Facebook, YouTube, and Second Life, you are not part of cyberspace anymore. Social Media allow firms to engage in timely and direct end-consumer contact at relatively low cost and higher levels of efficiency than can be achieved with more traditional communication tools. This makes Social Media not only relevant for large multinational firms, but also for small and medium sized companies. Using Social Media is not an easy task and may require new ways of thinking, but the potential gains are far from being negligible. Dell, for example, states that its use of Twitter, a micro blogging application that allows sending out short, text-based posts of 140 characters or less, has generated $1 million in incremental revenue due to sales alerts. Although specialised portals are very useful for supplying information to an organisation's customer base, the nature of these sites are such that communication tends to be one way, providing only limited opportunities for the customer to interact and provide feedback. Whereas, Social Media sites are centred on the idea of sharing and interaction, which ensures that your content is always fresh and that you are able engage in discussions with your customers. PDV foresaw how this type of interaction could be leveraged to provide a much more interactive perspective of customer requirements, and that a definite advantage could be obtained by actively engaging to become both producers and consumers of information, so-called *"prosumers"* (Toffler, 1980).

The approach that PDV decided to adopt with regard to the use of Social Media involved the defining and forming of groups, whose primary objective was the management of corporate Social Media, with full administrative rights to the system, with all other employees within the organisation having participation status. It was necessary to develop guidelines for Social Media usage throughout the organisation. These guidelines emphasised the need for every employee to identify himself or herself as such when posting a comment on the corporate blog. Otherwise, end-consumers could get the impression that anonymous accounts were being used to enable employees to post messages presenting an unrealistic positive perspective of the organisation. Management were conscious that this type of overzealous activity could damage the credibility of the Social Media campaign. This strategy proved to be extremely effective, in one particular instance where PDV decided to utilise Twitter to promote a number of sales promotions, the results were almost instantaneous, resulting in substantial incremental revenue generated. Use of social media is therefore, set to increase and become more tightly integrated within the emerging Web of social computing capabilities including; instant mobile messaging systems, sensor-based technologies like

Radio Frequency Identification, Near Field Communication, and new forms of location-based capabilities. Indeed, the whole phenomenon of social networks will continue to evolve fast as digital technology increasingly penetrates in the realm of the physical world.

6.7. Supply Chain Management

SCM is the oversight of materials, information, and finances as they move through the extended supply chain from the supplier to manufacturer to wholesaler to retailer and eventually on to the consumer. The imperative for organisations to adopt SCM as a top strategic objective and major e-business application development initiative is because SCM enables order processing, just-in-time inventory management, and timely order fulfilment. Fundamentally, supply chain management helps any firm get the right products to the right place at the right time, in the proper quantity and at an acceptable cost. The main objective of SCM is to manage this process efficiently by forecasting demand, controlling inventory, enhancing the network of business relationships a company has with customers, suppliers, distributors, and others, and receiving feedback on the status of every link in the supply chain. In order to achieve this, firms are today are turning to Internet technologies, Web enabled supply chain processes, decision making, and information flows (Ranjan, 2009). Management within PDV were aware that aspects of SCM represented a number of challenges for PDV both internally and externally to the organisation.

Within a supply chain context, a company's competitive strategy defines the set of customer needs that it seeks to satisfy through its products and services, relative to its competitors, (Chopra and Meindl, 2007). For any company to be successful, its supply chain strategy and competitive strategy must complement each other. This introduces the concept of strategic fit, which means that both the competitive and the supply chain strategies must be aligned together to achieve a common set of goals. It refers to consistency between the customer priorities that the competitive strategy hopes to satisfy and the supply chain capabilities that the supply chain strategy aims to build. The issue of achieving strategic fit is a key consideration during the supply chain strategy or design phase. All processes and functions that are part of a company's value chain contribute to its success or failure. These processes and functions do not operate in isolation; no one process or function can ensure the chain's success. Failure at anyone process or function however, may lead to failure of the overall chain.

In order to gain a greater understanding of the relationship between competitive and supply chain strategies, an analysis of the supply chain of a typical organisation, reveals the following components, which are illustrated in Figure 55. The front-end of the supply chain is normally concerned with Inbound Logistics, which consists of, the receiving and warehousing of raw materials and their distribution to manufacturing as they are required. The next phase, Operations, deals with the processes of transforming inputs into finished products and services. The third phase, Outbound Logistics, is concerned with warehousing and distribution of finished goods. The fourth phase, Marketing & Sales, deals with the identification of customer needs and the generation of sales. The last stage in the chain, Service, is concerned with the support of customers after the products and services are sold to them. Secondary supporting functions consist of; finance, accounting, information technology, and human resources that, support and facilitate the functioning of the value chain. To execute a company’s competitive strategy, all these functions play a role, and each must develop its own strategy.

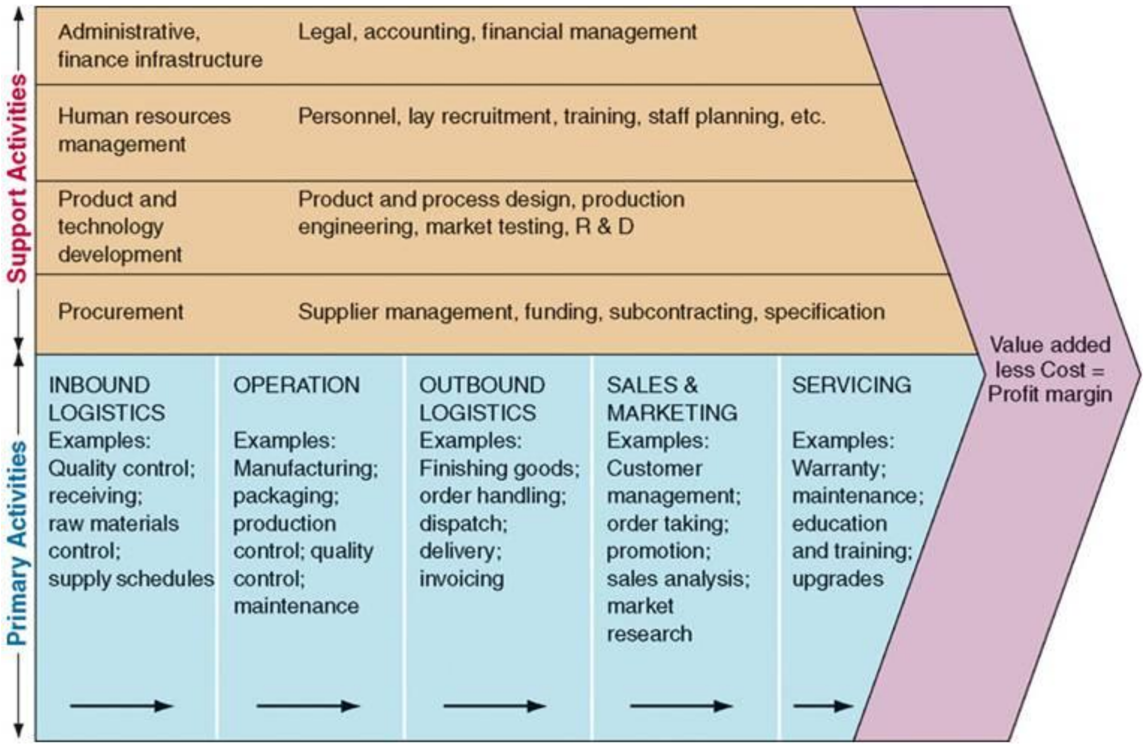


Figure 55: Supply Chain. *Source:(Chopra and Meindl, 2007)*

Prior to the introduction of the ERP system within PDV, conflicts within different sections of the supply chain were proving to be problematic. For example, the campaign which was been driven within the marketing department, was centred on the ability of PDV to provide a large variety of products very quickly. However, within the logistics department, emphasis was been put on targeting distribution costs, particularly, those associated with transportation. Orders for goods were deliberately being delayed, in order to obtain better transportation costs through economy of scale by grouping orders together or using inexpensive but slow modes of transportation. This strategy however, was in direct conflict with the goal to provide variety quickly. A similar problem manifested itself in relation to inventory levels. PDV were, as a matter of policy, carrying relatively low levels of inventory. However, due to the policy of keeping transportation costs low, the suppliers and carriers selected were unable to provide the level of responsiveness required, leading to situations which resulted in poor product availability. A supply chain's responsiveness includes a supply chain's ability to do the following:

- Respond to wide ranges of quantities demanded.
- Meet short lead times.
- Handle a large variety of products.
- Build highly innovative products.
- Meet a high service level.
- Handle supply uncertainty.

Responsiveness however, comes at a cost. For instance, to respond to a wider range of quantities demanded, capacity must be increased, which increases costs. The cost-responsiveness efficient frontier of an organisation is therefore, represented by the ability to provide the lowest possible cost for a given level of responsiveness. Lowest cost is defined based on existing technology; not every firm is able to operate on the efficiency frontier. The efficiency frontier represents the cost-responsiveness performance of the best supply chains. This relationship is represented by the *"Zone of Strategic Fit"* illustrated in Figure 56. For a high level of performance, companies should move their competitive strategy and supply chain strategy toward the zone of strategic fit.

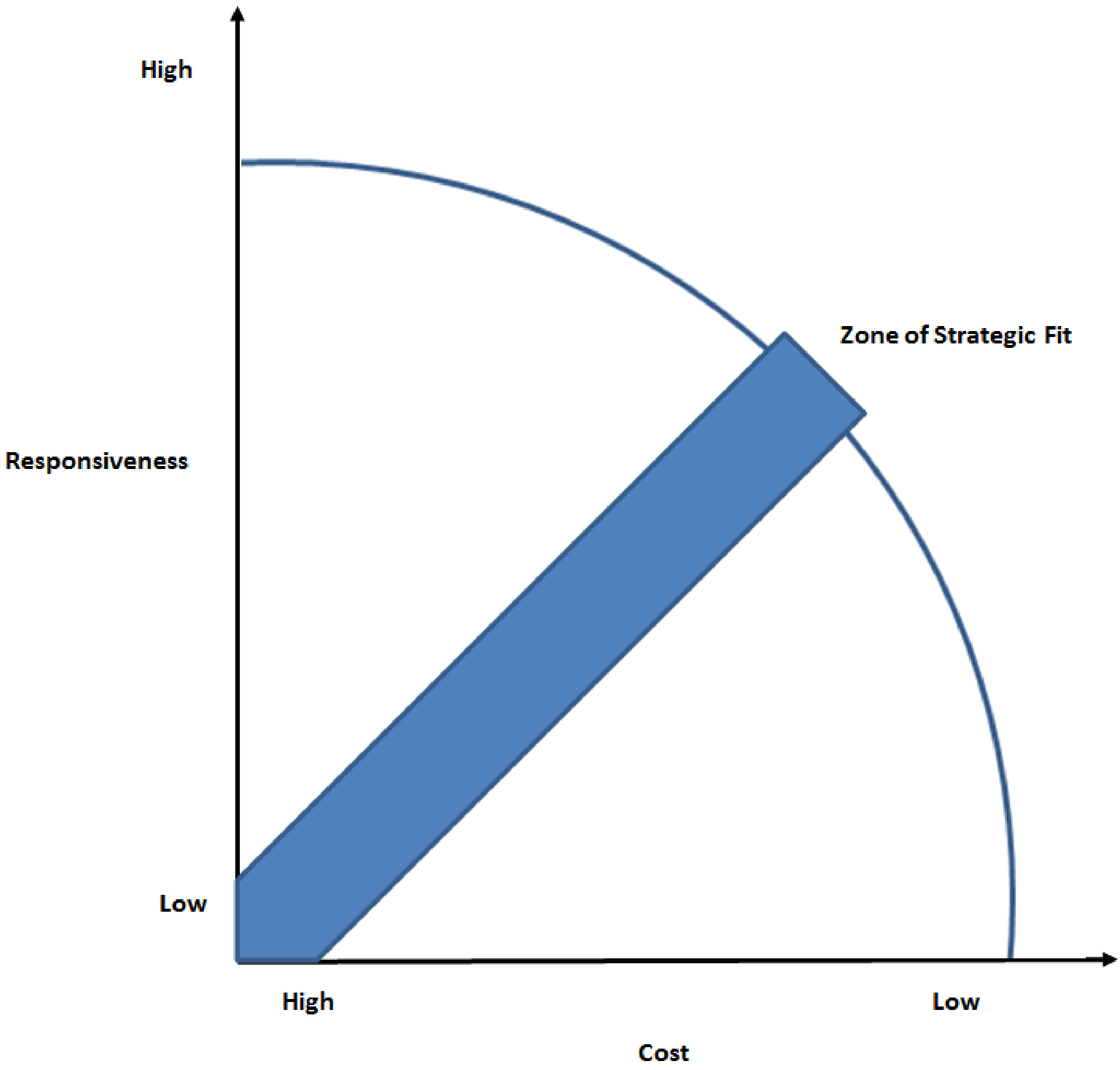


Figure 56: Zone of Strategic Fit. *Source: (Ambe and Badenhorst-Weiss, 2011)*

PDV like many other organisations has to operate within certain constraints which come about as a consequence of the sector in which they operate. Many organisations are now experiencing environmental changes resulting from the new economics of information and the increasingly dynamic and global nature of competition (Evans and Wurster, 2000), and the point has been made by (Dijksterhuis *et al*., 1999) that, organisational survival depends on the construction and integration of knowledge fostering the adaptation to the environment, as well as stimulating environmental changes through the firm's knowledge and practices. Limited ability to raise prices, high-customer expectations and low levels of loyalty, resulted in increased challenges in an already competitive market for all retail organisations (Taylor *et al*., 2004). From a customer service perspective, the key attributes within the supply chain that PDV must be able to satisfy are:

- ❖ Availability of product whenever they want it.
- ❖ A low or fair price.
- ❖ Value for money.
- ❖ Quality commensurate with the price.
- ❖ A broad selection of choice.
- ❖ Easy ordering if out of stock.

Within this context PDV realised that it would be necessary to employ supply chain analytics in order to reduce cost and improve customer service. This could only be realised by defining the analytical needs of the organisation through a well-defined key set of metrics in line with the organisational strategy. Supply chain efficiency can be monitored by a number of key metrics. These include:

- ❖ Cost of goods sold.
- ❖ Inventory turn.
- ❖ Inventory service level.
- ❖ Inventory carrying cost.
- ❖ Lead-time.
- ❖ Vendor performance.

Within PDV the methodology employed to ensure strategic fit across the supply chain within the organisation was to assign roles to different stages of the supply chain that ensured the appropriate level of responsiveness. This was achieved by assigning different levels of responsiveness and efficiency to each stage of the supply chain. The intelligent use of BI within PDV, enabled for the continuous monitoring and analysis of key critical indicators that provide value within the organisation, such as current transportation time for shipping, transportation cost, utilisation of any transportation vehicle. The utilisation of BI in real-time, allowed for the early detection of situations, with regard to planning and coordination of the logistics within the supply chain, such as a delay of freight, or loading goods into a wrong container. When situations like this were detected, action could be taken to either change the transportation route, or change the mode of transportation. In cases where a failure of the internal distribution network, could not respond to customer requirements, use could be made of specialist carriers in order to ensure delivery to the customer in a timely manner. In an extreme case, which resulted in failure of delivery, the real time BI system automatically sent out a notification to the customer, advising of the delay, and the new estimated delivery date.

6.8. RFID

Another important initiative within the BI context that PDV decided to undertake was to employ Wireless Technology using Radio Frequency Terminals (RFT). These terminals were not only made available to personnel within the warehouse, but were also mounted on forklift trucks. The use of these devices significantly improved accuracy levels, and allowed warehouse personnel to be able to do their job on the move. Within the warehouse RF terminals are used for goods receiving, controlling, stacking, picking, dispatch assembly, and physical inventory counting. These terminals communicate with the warehouse management system in real time, allowing for data integrity checks, lower operating costs and reduced costs of rectifying errors. Another initiative which was taken with respect to RF technology was to replace the use of bar-code scanners with Radio Frequency Identification (RFID) technology, which is a technology that can be used for the automated identification of objects and people. An RFID device, frequently just called an RFID tag, is a small microchip designed for wireless data transmission. It is generally attached to an antenna in a package that resembles an ordinary adhesive sticker. The microchip itself can be as small as a grain of sand, some 0.4mm2 (Takaragi *et al*., 2001). An RFID tag transmits data over the air in response to interrogation by an RFID reader. Although bar-coding represented a significant advance in inventory control and warehousing, there were a number of requirements that this technology did not satisfy.

One of the major limitations of the technology is the requirement for a physical presentation of the bar-coded item to the scanner. In contrast, RFID systems have no line-of-sight requirements and non-contact readability ranging up to 30 metres or more, depending on the tag and reader size as well as the frequency used. This is a great advantage in warehousing situations where JIT methodologies are employed, where the objective is to keep inventory constantly moving. RFID tags allow greater placement flexibility than bar code labels and require virtually no maintenance. RFID also allows *"on the-fly"* identification, where tagged objects do not need to be stationary to be read. Another advantage that RFID offers is that of unique identification. A barcode indicates the type of object on which it is printed, e.g., *"This is a 100g bar of ABC brand 70 per cent chocolate."* An RFID tag goes a step further. It emits a unique serial number that distinguishes among many millions of identically manufactured objects; it might indicate, e.g., that *"This is 100g bar of ABC brand 70 per cent chocolate, serial no. 637348738.1"* The unique identifiers in RFID tags can act as pointers to database entries containing rich transaction histories for individual items (Juels, 2006). PDV decided to exploit the ever decreasing cost of RFID tags. RFID technology was used extensively to locate mislaid products, to deter theft, and to offer customers personalised sales pitches through displays mounted throughout their stores. The ultimate goal of PDV is look at the possibility of significantly reducing labour costs associated with the checkout process. PDV were able to realise warehouse and general labour costs by 6 per cent, as a result of using this technology, mainly as a result of a more efficient receiving, shipping, and exception handling. Also, by exchanging the information gleaned from RFID readers over the Internet, PDV was able to manage its own stock replenishment for key customers more efficiently, saving both parties 20 per cent in inventory and out-of-stock costs.

6.9. Forecasting

The complexity and uncertainty that exist in the supply chain make the concept of accurate and effective forecasting an elusive target. Traditionally this task had been carried out using spread-sheet analysis, based on performance data of the last financial quarter. The problem with using only historical data to predict the future is that it requires the assumption that the patterns that have occurred in the past will occur again in the future. In today's ever changing market this may or may not be a valid assumption. This process was slow and cumbersome and prone to error, due to the large number of data entries required, and also the entering of a large number of complex equations, in order to perform the analysis. This process provided a flat forecast of demand and did not take into account different demand patterns for various types of products. The challenges involved in creating a credible forecast are pretty formidable and require a high level of skill across a range of disciplines. The marketplace is constantly changing, which results in a constant flow of new products, and changing channels of distribution. Forecasters, today need more information, using a forecast based on history *"makes as much sense as driving a car by looking in the rear-view mirror, they need to be looking ahead, not back"* (Fulcher, 1998). The approach taken within PDV to address these uses was to make use of Collaborative Planning, Forecasting and Replenishment (CPFR). CPFR is a Web-based set of applications that assist in coordinating the various activities including production and purchase planning, demand forecasting and inventory replenishment between supply chain trading partners. Its objective is to exchange selected internal information on a shared Web server in order to provide for reliable, longer term future views of demand in the supply chain. This is a technology that supersedes the earlier approach of EDI. EDI suffered from a number of drawbacks. It was a much slower technology, which often required the manual entering of identical data (Joachim, 1998), and it is more expensive than CPFR given its proprietary nature, variety of standards, and the reliance on value added networks, or VANs (Cooke, 1998). What makes CPFR unique is that this joint business plan is used to control the day-to-day activities of manufacturing, delivering and selling products. The early exchange of information between trading partners provides for reliable, longer term future views of demand in the supply chain. The forward visibility based upon information sharing leads to a variety of benefits within supply chain partnerships (Yu *et al*., 2001). The benefits for the retailer include:

- Increased sales.
- Higher service levels.
- Faster order response times.
- Lower product inventories.

The practice of collaboration has been encouraged by a variety of industry initiatives, such as Just In Time (JIT), Computer-Assisted Ordering (CAO), Vendor-Managed Inventory (VMI), Efficient Consumer Response (ECR), and the collection and exchange of retail POS data. These initiatives encourage supply chain partners to collaborate and share information over the control and reduction of inventories (Stedman, 1998). Although the methodology is applicable to any industry, CPFR applications to date have largely focused on the food, apparel, and the general retail sector. There are a number of forces that drive the need for the early exchange of reliable information in these particular industries. One of these driving forces is competition. Retailers in the U.S, such as Wal-Mart and K-Mart have expanded product offerings into food items in order to enhance the value of their customer service offerings through one-stop shopping. In response, food retailers developed the ECR initiative in 1993, which was aimed at increasing supermarket efficiencies in light of the competitive threat of the large retailer super-centre concept (Fliedner, 2003). The implementation of CPFR requires that there be a high level of trust between the participating partners. One of the factors that mitigates against the full implementation of the system can arise due to a lack of trust over complete information sharing between supply chain partners (Stein, 1998). The conflicting objective between the profit maximising vendor and cost minimising customer can result in an adversarial supply chain relationship. PDV did not encounter too many problems of this kind. Most of the partners involved appeared to be more than willing to share information within the system, in order to provide real benefit from within it. From a management perspective CPFR implemented through BI platforms provided a strong transaction foundation among the various planning systems via the Internet. CPFR provided the ability to provide automatic transfer of supply chain partner demand forecasts into its own inventory schedules, and into its supply chain planning applications such as the warehousing and inventory control applications. Through the use of these techniques, PDV were able to dramatically reduce inventories and lead times while increasing customer service and forecasting accuracy. The result of using this methodology within PDV can be seen in Figure 57.

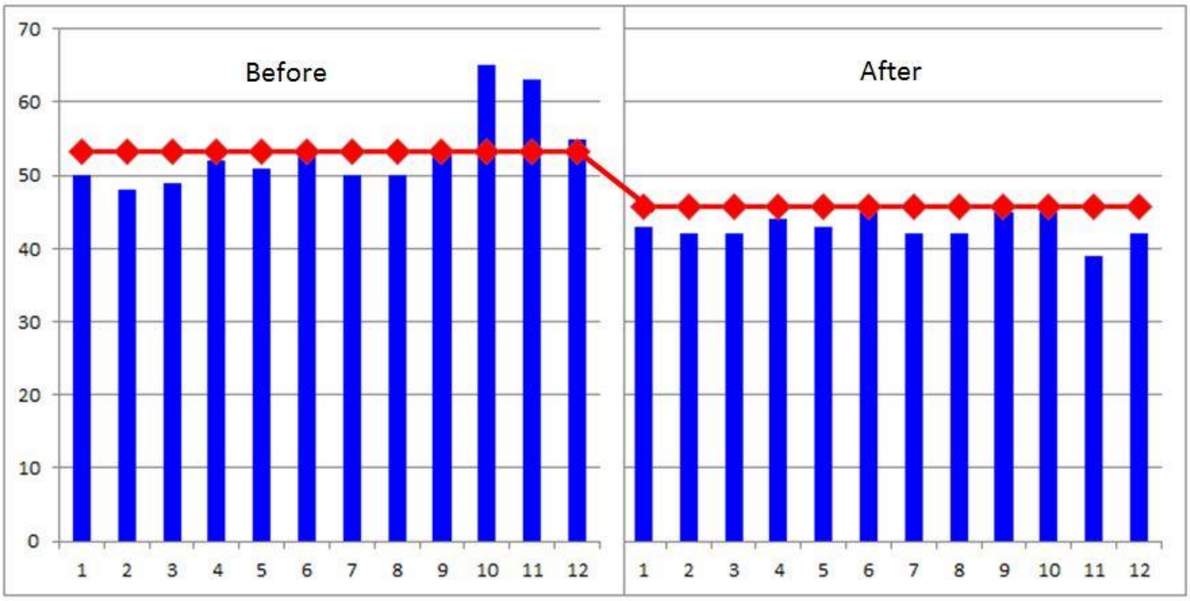


Figure 57: Before and After Forecasting Error

The chart on the LHS of the figure illustrates the forecasting error within PDV prior to the twelve months prior to the implementation of the BI initiative. It can be seen from the chart that the average forecasting error is 53.25 per cent, with the bulk of the variation occurring towards the end of the year. The chart on the RHS illustrates the situation after the application of the BI initiative. The average variation has been reduced to 42.83 per cent with much less variation occurring towards the year end. This represented a performance improvement of nearly 20 per cent in real terms, which represented a real-step improvement.

6.10. Inventory Control

Encouraged by these results PDV decided to extend the BI methodology into the area of Inventory Control. Inventory control is concerned with minimising the total cost of inventory. The three main factors in inventory control decision making process are; the cost of holding the stock, the cost of placing an order, the cost of shortage. The cost of a shortage is sometimes difficult to measure and is often handled by establishing a *"service or safety level"* policy, whereby a certain percentage of demand will be met from stock without delay. PDV faced increasing pressure to reduce inventories across the supply chain. However, in complex supply chains it is not always obvious where to hold safety stock to minimise inventory costs and provide a high level of service to the final customer. In an attempt to address these challenges, the decision was taken to move to a Vendor Managed Inventory (VMI) system within the organisation. VMI is essentially a partnering initiative for improving multi-firm supply chain efficiency, also known, as continuous replenishment or supplier-managed inventory. Like so many initiatives with regard to supply chain management, it was a methodology first put forward by Wal-Mart and Procter & Gamble in the late 1980s. VMI very quickly became one of the key programmes to provide organisations with the ability of a *"quick response"* with regard to their supply chain capability.

Successful VMI initiatives have been implemented by companies in the United States, including Campbell Soup and Johnson & Johnson, and by European firms such as Barilla, the pasta manufacturer. When a VMI partnership is established, the supplier, usually the manufacturer but sometimes a reseller or distributor, makes the main inventory replenishment decisions for the consuming organisation. This means that the vendor must possess the ability to monitors the buyer's inventory levels through a Web-based network. The vendor then makes resupply decisions regarding order quantities, shipping, and timing. This in effect, reverses the roles of the vendor and the buyer, as purchase orders in this system are initiated by the supplier. In this system, a purchase order acknowledgement from the vendor may be the first indication that a transaction is about to take place. An advance shipping notice from the vendor informs the buyer that the materials are in transit. In this relationship, buyers relinquish control of key resupply decisions and sometimes even transfer financial responsibility for the inventory to the supplier. This arrangement transfers the burden of asset management from the consuming organisation to the vendor. The implementation of this phase of the programme was quite complex and it required working very closely with several different vendors over a thirty six month period. Not-withstanding this, the results achieved from this phase of the programme, which are illustrated in Figure 58 were quite impressive.

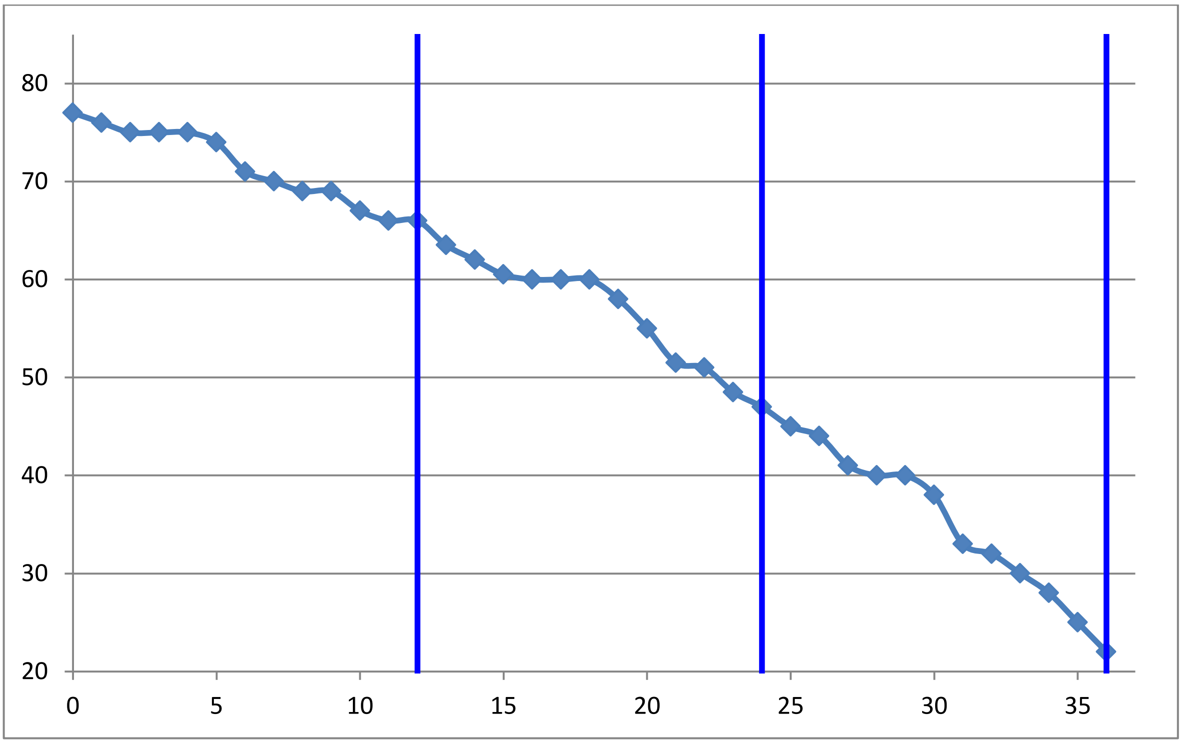


Figure 58: PDV Inventory Levels

Whereas, at the beginning of the programme, inventory levels were approaching nearly 80 per cent of total stock, this was brought down, over the thirty six month period, to just over 20 per cent. A major component that contributed to the fall in inventory levels was the change which occurred in the order frequency from the vendors in question. This is referred to as the Cycle Inventory, which is the average amount of inventory used to satisfy demand between receipts of supplier shipments. It was an established tradition within PDV to have a cycle inventory which resulted in the purchase of material in large lots. This was done in order to exploit economies of scale in the transportation purchasing process, as well as the overall supply chain, as the large lot sizes cut down on the overall transport cost, thus cutting down costs in the shipping and receiving department. However, when a cost analysis was performed between the cost of holding inventory and the cost of shipping from the vendors, the analysis demonstrated that it was in fact, much more cost effective to take much more frequent deliveries from the vendors. A major component of the cost saving involved, came about as it was now possible for PDV to reduce their safety inventory levels considerably, due to the more frequent deliveries from the vendors. Safety Inventory is inventory held in case demand exceeds expectation; it is held to counter uncertainty. If demand was predictable, safety inventory, or buffer stocks would not be required. However, because demand is uncertain and at times, exceeds expectations, it is necessary to hold safety inventory to satisfy an unexpectedly high demand. Many of the costs associated with holding inventory are hidden, and therefore not immediately obvious. Costs involved, include the cost of building rental and facility maintenance and related costs, and the cost of material handling equipment, along with operational costs, consumables, communication costs and utilities. There are also, costs associated with IT hardware and applications, including cost of purchase and depreciation, and finally there are the human resources, which are employed in operations as well as in management.

6.11. E-Learning

PDV were very conscious that, with the introduction of so many new technological systems into its organisation, that the operation and interaction with these new systems could represent a challenge to many of its employees. It would therefore, be necessary for PDV to find a way to keep all of its employees up to date with regard to the skills that they would require in order to interact and operate the new technological systems. How to effectively provide the necessary training that was required across the organisation was another challenge that PDV had to consider. It is increasingly recognised that within the workplace there is increased pressure to identify the most constructive and cost-effective ways of using communication technology as a resource for learning (Guile, 1998), coupled with an increasing emphasis on self-directed and lifelong learning (Delors, 1998). Before embarking on any training programmes, it was first of all, important to understand how the needs of both the management and the employees would best benefit from such training. According to (Blocker, 2005), e-learning addresses business issues such as reducing costs, providing greater access to information and accountability for learning, and increasing employee competence and competitive agility. According to (Crowley, 2002), *"Cisco maintains that e-learning can be thought of as a critical element of any enterprise workforce optimisation initiative"*. According to (Sambrook, 2003), e-learning, can be defined as any learning activity supported by information and communication technologies, and it encompasses training, education information, communication, collaboration, knowledge management and performance management. Previous research into this area, has been undertaken by (Moon *et al.*, 2005), across a number of European countries, using focus groups in order to ascertain their views about the type of courses that should be designed, the course content, and how they should be delivered. This led to the identification of eleven themes around which possible course structures could be built. These were identified as:

1. Move the business forward: create a culture of constant change.
2. Build a winning team: build a team of people who share your vision and will help you to achieve it.
3. Communicate effectively: establish good communications at all levels.
4. Cultivate networks and relationships: cultivate a network and build relationships with other people.
5. Gain insights: learn from experience, admit your mistakes.
6. Deal with people: understand what makes people tick, be aware of your impact on others.
7. Handle information: retrieve what is important, monitor key trends, and improve your search skills.
8. Manage tasks: plan thoroughly, establish priorities, delegate.
9. Focus on process and product: correct balance can mean the difference between success and failure.
10. Take risks more safely: move out of the comfort zone; be proactive, anticipate.
11. Tackle problems: have a repertoire of strategies and creative approaches.

The outputs of the focus groups included a number of case studies, which were useful in encouraging reflection on real-life issues (Denning, 2001), and these were to be rewritten to form part of the new course material, together with key design requirements from the organisational point of view regarding what would constitute a successful online course. This demonstrated clearly that, what management really required from such courses, was that the information that they provided would be:

- ❖ Relevant to their everyday business lives, practical not theoretical and should include *"real"* stories.
- ❖ Offer opportunities for self-reflection.
- ❖ Provide access to a virtual network of SME managers; and provide small bites or *"chunks"* of material to fit in with busy working lives.

Based on this research, PDV decided to implement a number of learning programmes throughout the organisation that included those points that had been identified above. The main benefits that were obtained from implementing e-learning programmes in this way were that it was possible to distribute e-learning programmes anywhere, any time and cost-effectively. Also, the fact that these programmes were being provided through the e-learning platform, encouraged management within PDV to use the technology for their own benefit, and the learning experience, as opposed to using the technology for the technology's sake, or indeed resisting the use of the technology. A key message therefore, for these managers was that it was necessary to embrace the technology in order to enhance their learning experience, as opposed to resisting or ignoring the technology. The capability of PDV to be able to design and deliver quite a number of training modules across its different levels of management and also to a significant number of employees was instrumental in building support for these programmes among all of its employees. Using the e-learning platform also conferred a considerable cost advantage compared to using traditional learning channels, such as sending employees on specialised training programmes, or having specialist training agencies deliver the training, all of which incurs a lot of additional expense, not to mention the lost time that results from employees having to attend out of town training courses.

6.12. Dashboards and Reports

The ability to analyse data to predict market trends of products and services, and to improve the performance of enterprise business systems, has always been part of running a competitive business. With ever-increasing competition and rapidly changing customer needs and technologies, enterprise decision makers are no longer satisfied with scheduled analytics reports, pre-configured key performance indicators, or fixed dashboards. They demand ad-hoc queries to be answered quickly, they demand actionable information from analytic applications using real-time business performance data, and they demand these insights be accessible to the right people exactly when and where they need them. Furthermore, since there are too many overlapping data sources with varying qualities, they want more control over the data used for analysis , insights derived from out of date, wrongly purposed and poor quality data can do more harm than good (Azvine *et al.*, 2005). Management within PDV have a keen interest in being able to generate tailor made reports based on the data within the EDW. One of the reasons that PDV decided to implement the Teradata solution was because of the particular capabilities that the MicroStrategy tool could perform in this regard. The reporting system centred around a corporate portal, which provided a framework for integrating information, people, and processes across all of the organisational boundaries. The benefits of utilising the portal included:

- ❖ Management were provided with a single location to access their dashboards as well as documents, presentations, and online discussions, along with other applications.
- ❖ Single sign-on to multiple aspects of the reporting structure was made possible, eliminating the need to maintain multiple passwords and having to log in to multiple applications.
- ❖ Efficiency was greatly increased as management could now go to a single location to access a variety of related and unrelated information.
- ❖ It allowed the establishment of a central point, to deploy many its BI applications.

The system runs hundreds of reports which are continually generated from data within the EDW. The interface gives users the ability to apply filters to these reports, with the capability to drill down to the underlying data. If there is a requirement for a particular report which is not being generated automatically by the system, users have the capability to generate their own personalised reports based upon their own queries. This level of report generation gives key personnel within the organisation the capability to oversee all facets of the supply chain. Specific locations within the supply chain, where inventory is building up can be quickly identified. It is also relatively easy to identify those products which are generating the most margins, and which products are not. This provides management with the ability to apply different marketing strategies within their product range to ensure that slow moving items are priced more competitively in order to boost sales for these particular items. Sales personnel within PDV are set targets that they are expected to meet on a quarterly basis. Scorecards, which are generated by MicroStrategy allows each member of the sales team to see how they are performing against the set goals on a continuous basis. This provides members of the sales team with real-time data of how they are performing against the set targets. It is also possible to segment revenue data based on the particular channel that generated it. In this way the performance of the individual retails stores can be quickly evaluated, and this in turn can be compared to revenue generated form the e-commerce channels. The portal provided the ability to access Web-based applications through hyperlinks, with these links being embedded in the most relevant areas of a dashboard portal page. This proved extremely useful to management who wished to access information that had relevant context to a dashboard or a component on a dashboard. For example, a hyperlink to a detailed financial report could be placed next to a financial chart showing actual and budget figures for an entire Profit and Loss report. PDV utilised strategy maps and scorecards based on its managerial strategies and tactics. This proved to be very helpful in assisting management to visualise and track their goals and tactics. The dashboards were than able to display key performance-related charts and indicators together with strategy maps and scorecards to assist the management team to focus their resources on the most important performance related, activities and drivers. A typical enterprise performance management dashboard generated by the system is illustrated in Figure 59.

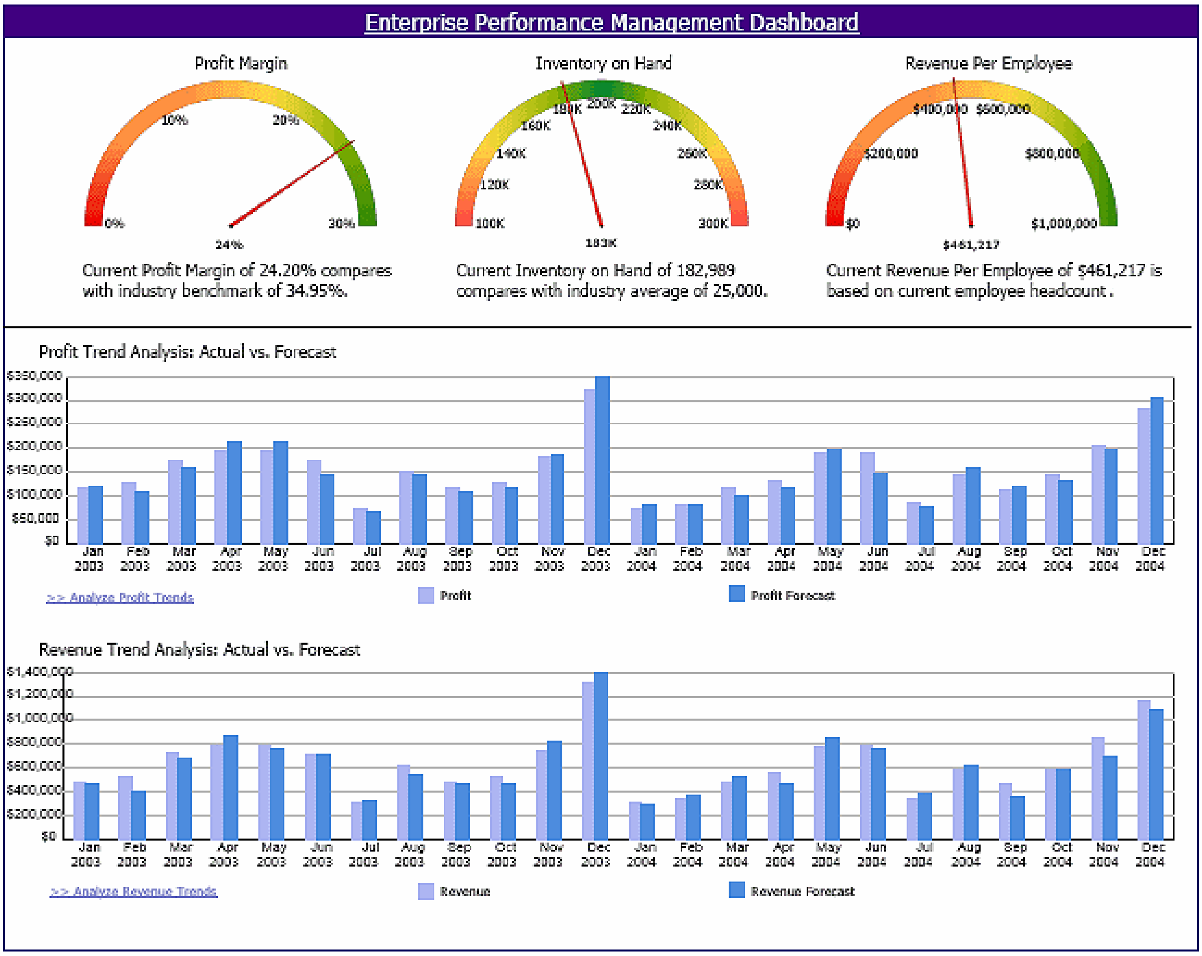
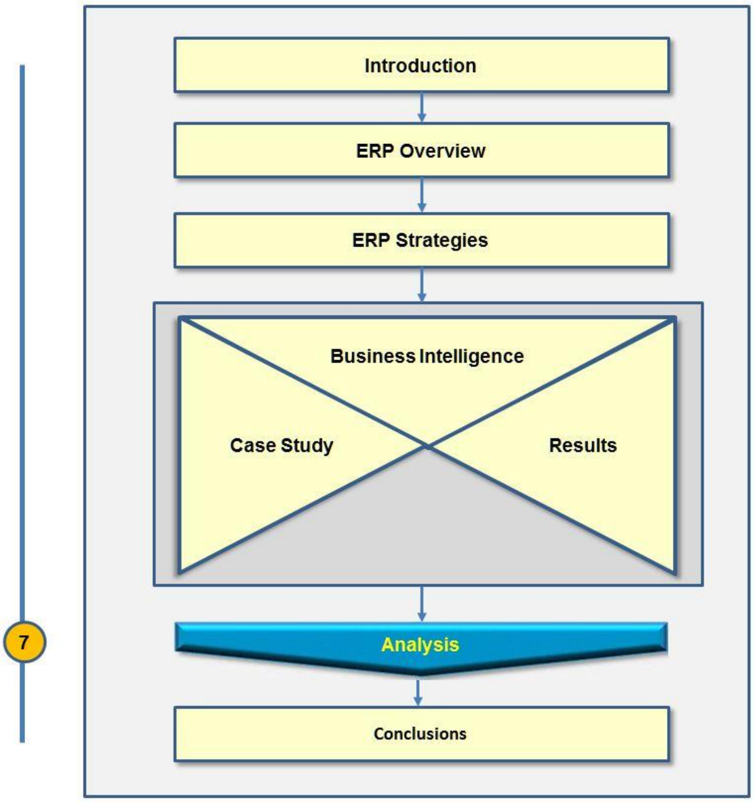


Figure 59: PDV Performance Management Dashboard

Chapter 7

Analysis

"Nothing in the world can take the place of persistence. Talent will not; nothing is more common than unsuccessful individuals with talent. Genius will not; unrewarded genius is almost a proverb. Education will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent." - Ray Kroc



Prior to discussing the research questions in detail, the issues concerning the cost benefit analysis through the use of BI will be discussed.

7.1. Benefits Versus Costs

While it is relatively easy to quantify the costs associated with implementing BI, it can be a much more difficult task to quantify and calculate the benefits associated with it. Soft benefits, such as the ability to assist in formulating strategic decisions, are somewhat more difficult to quantify, and therefore, it makes the task of justifying the considerable investment involved in BI systems somewhat more difficult. In purely financial terms, the business value of an investment is measured as the net present value of the after tax cash flows associated with the investment. An investment in BI creates an asset that must be used to generate incremental after-tax cash flow. Accordingly, BI investments should be subjected to a rigorous assessment of how the investment will result in increased revenues, reduced costs, or both. The two primary categories, into which benefits can be attributed, have been identified as, revenue enhancements and cost savings. Cost savings are defined as the difference in the costs associated with the new BI initiative versus the costs associated with maintaining the existing information environment. Revenue enhancements are defined as the beneficial activities that result from decisions individuals make by using information from the BI solution.

Some of the main advantages that are put forward by those who propose BI solutions are business benefits such as; collaboration, information sharing, flexibility, responsiveness, agility, and customer intimacy. However, it is not always possible to define all of these attributes in purely operational terms that can be realised through business processes that affect revenues or costs. This can result in a situation whereby revenues may fall, for a period of time after the implementation of the BI system. Many organisations use BI systems to improve customer segmentation, customer acquisition, and customer retention. The intent is that these improvements will result in reduced customer acquisition costs, increased revenues, and increased customer lifetime value, which result in increased revenues. An investment in a BI system that improves demand forecasting will be of limited use unless the forecasts are actually incorporated into operational business processes that can then deliver reduced inventory, reduced order expediting costs, and other material benefits to the organisation. The objective of delivering business value via BI should be to determine how an organisation can use BI to:

❖ Improve management processes, such as; planning, controlling, measuring, monitoring, and changing, in such a way that management can increase revenues, and reduce costs.

❖ Improve operational processes, such as; fraud detection, sales campaign execution, customer order processing, purchasing, and accounts payable processing to allow the organisation to increase revenues, and reduce costs.

According to (Williams *et al*., 2003), the business value of BI lies in its use within management processes that impact operational processes that drive revenue or reduce costs, in its use within those operational processes themselves. This concept is further illustrated by (Moss and Atre, 2003), who illustrate, what they refer to as the four dimensions of BI benefits (Revenue Enhancements, Cost Savings, Management Process Improvement, and Operating Process Improvement). This concept is illustrated in Figure 60.

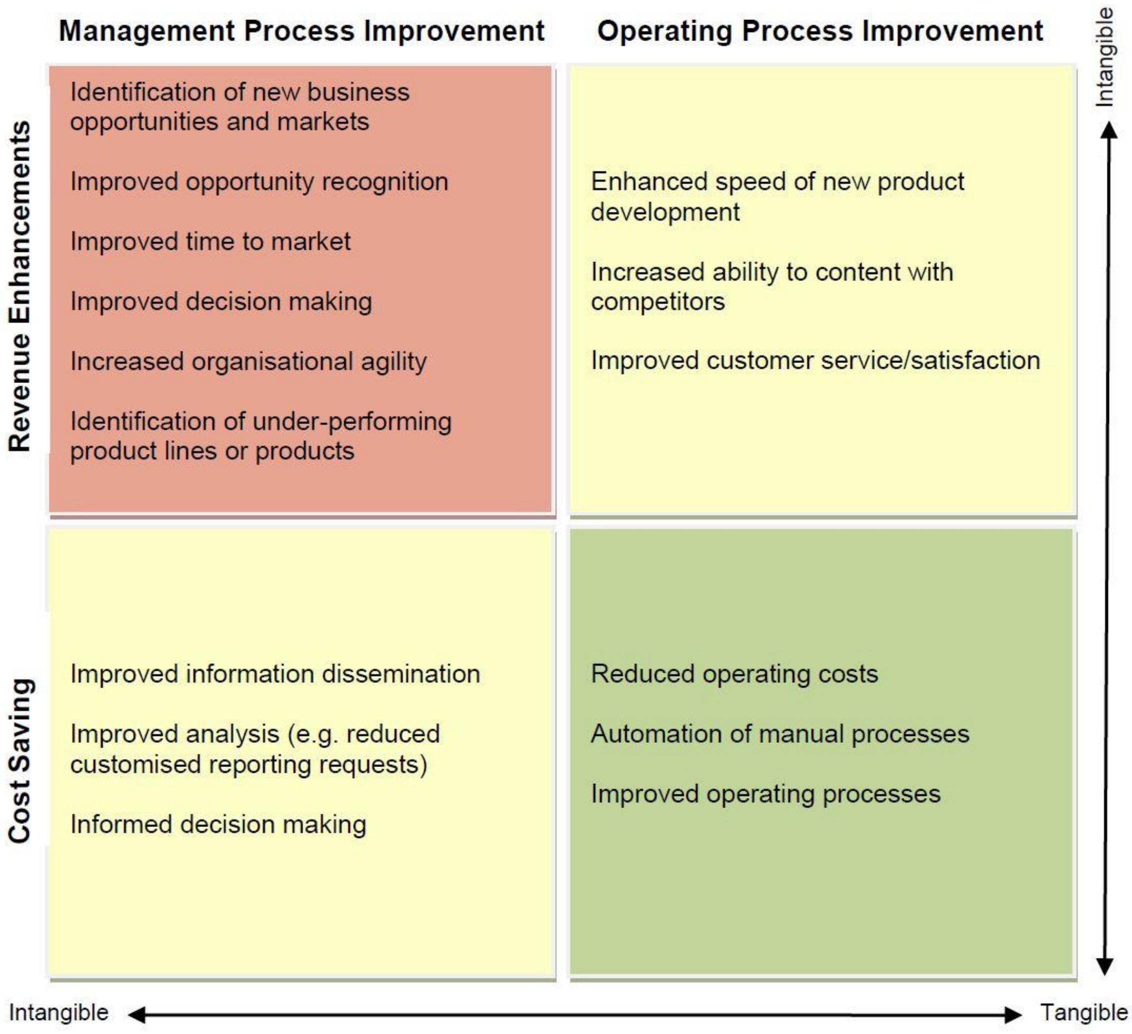


Figure 60: Quadrant graph for generic BI benefits classification. *Source: (Moss and Atre, 2003)*

In this model, the top-left square identifies the BI solution's impact on revenue enhancement through management process improvement. The bottom-right square contains benefits of operational process improvement associated with cost savings. In contrast to *"red"* benefits, these benefits are easy to identify because of the ability to compare the new BI solution to the old operational environment. Finally, bottom-left and top-right boxes contain intangible benefits which could be estimated through a more complex range of evaluation methods. The author notes however, that due to the nature of the intangible benefits that this model offers, its use and benefits are of a somewhat limited nature. However, what this does illustrate (See Figure 61), is the need to ensure that BI is used in a way that has an operational impact, and that organisations must look beyond the initial rollout of BI applications. Capturing the business value of BI requires that organisations to go well beyond the technical implementation of a BI environment. Specifically, organisations must engage in effective process reengineering and change management in order to capture business value from BI.

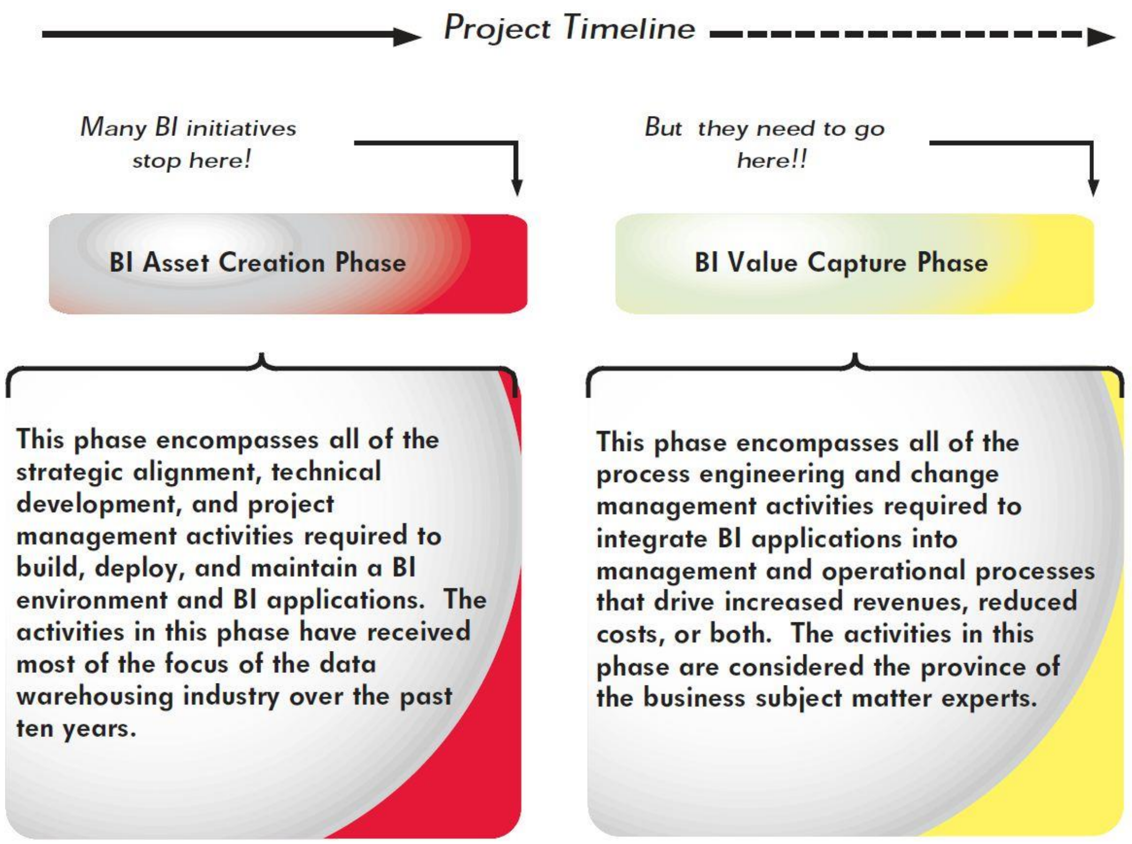


Figure 61: Capturing Business from BI. *Source: (Williams et al., 2003)*

7.2. The Primary Research Questions

In the introductory section of this thesis, the hypothesis and the primary research questions that this thesis would address were stated as follows. It is the purpose of this thesis to demonstrate that:

Business Intelligence strategies, correctly applied, and in combination with e-marketing and Website development, can have a beneficial effect on organisational development, that has not been previously realised within organisations.

The primary research objectives that this thesis addresses are as follows:

- ❖ To evaluate how ERP can be employed to provide an internal competitive advantage and how BI can be best employed in order to leverage the benefits of existing ERP systems.
- ❖ To investigate the role of BI in facilitating organisations in their efforts to achieve external competitive advantage and the extent to which organisations are leveraging the synergy, that BI solutions can offer.
- ❖ To establish the barriers of entry for smaller organisations who wish to employ the technology.

Each of these points will now be discussed to establish to what extent, and how effectively these issues have been addressed.

7.3. Objective 1

To evaluate how ERP can be employed to provide an internal competitive advantage and how BI can be best employed in order to leverage the benefits of existing ERP systems.

It has been demonstrated that both ERP and TQM have been employed to great effect within PDV. These tools, combined with the use of a sound reengineering methodology were instrumental in providing the required technological advancement that was required within the organisation for the control, tracking and controlling of critical transactions. ERP driven through an advanced IT infrastructure greatly enhanced the real-time flow of information throughout all sectors of the organisation. Although the original intent of the ERP programme was that, it should be applied with an organisational focus, it soon became apparent, that the technology could be applied to great effect right across the extended supply chain. IT and

Web based technologies have been instrumental in bringing about a revolution with regard to supply chain thinking. Although reengineering was used to great effect at critical points within the overall programme, the benefits that the application of sound TQM techniques could bring to the programme were never lost sight of. Almost without exception the successful exponents of BPR have been, and continue to be committed to the TQM process. TQM puts a heavy emphasis on the need to change people's behaviour, attitude and philosophy of doing business. In other words, TQM provides the essential cultural framework and foundation to enable BPR to be successful. It should be noted however, that an ERP system in itself cannot provide a sustainable source of competitive advantage. ERP within itself is not sufficient to guarantee a strong competitive position within a dynamic knowledge economy. If the impact of ERP on the organisation only results in the streamlining of tasks, managing data, and changes to the procedures that people use to do their work, it is unlikely to provide long-term competitive benefits (Kalling, 2003). To promote a sustained competitive advantage, firms must be able to use ERP in distinctive ways, or in ways that enable the firm to accomplish distinctive outcomes. Sustained competitive benefits only emerge from a firm's ability to create new organisational capabilities that set the firm apart from its rivals, and from the ability to change people's behaviours. However, the characteristics of ERP do offer a platform for enhancing a firm's social and intellectual capital in ways that can lead to effective and sustained advantages in the knowledge economy (Nahapiet and Ghoshal, 1998). From a PDV perspective, four distinct advantages arose from the implementation of the ERP programme.

1. ERP provided an information portrait of the entire enterprise that incorporated all functions and departments. This promoted consistency in data across the organisation.
2. ERP provided a single, comprehensive database in which all business transactions could be entered, recorded, processed, monitored and reported. This made a great deal of tacit knowledge explicit and enabled the coordination necessary for customer-driven strategies.
3. ERP increased information transaction speed quite significantly. This, in turn, led to cycle time reductions, improved financial management, better capacity management and similar quick-response benefits.
4. ERP increased connectivity across multiple processes. PDV could now track the consequences of choices made in one unit across all other enterprise

activities. Connectivity enables firms to use comprehensive performance assessment tools like the balanced scorecard, and provides the feedback needed to track enterprise-level progress.

These four attributes of ERP systems are valuable competitive assets because of the benefits of seamless functional integration, plus they enable firms to more effectively leverage their other key resources. These attributes combined with the fact that, an integrated IS that cuts across boundaries and reaches suppliers and customers, allows a firm and its extended supply chain to function as a total enterprise system. ERP provides the foundation for efficient and flexible supply chain management, customer relationship management, make to-order manufacturing, business intelligence and e-commerce (Plotkin, 1999), and the use of these resources and capabilities enabled PDV to capitalise on market opportunities and avoid threats adeptly, efficiently, and in ways that created value for customers, and also assisted in promoting customer loyalty. The ERP system enabled PDV to accurately assess and tightly coordinate production capabilities. The precise and reliable information that resulted from these activities enabled PDV to develop better, more responsive relationships with customers. ERP allowed PDV to coordinate and manage the entire supply chain more efficiently and smoothly than had previously been possible with the legacy systems which PDV had been utilising. The net result is a much more tightly orchestrated and efficiently controlled production system that extends beyond the boundaries of the enterprise.

7.4. Positioning the Technology

When the decision was being made to evaluate, which vendor of BI solutions was best positioned to assist PDV with its endeavours, consideration was not only given to a *"Best Solution Provider"* but also, to how the competing players within the marketplace were best positioned to assist PDV over the long haul. Assessing the capabilities of participants within a given marketplace can be a daunting task. Vendor differentiation caused by differing sizes, levels of complexity and strategies can inhibit comparisons of vendor offerings, and the market's overall direction is often difficult to perceive. A tool that PDV found useful in forming this decision was another model provided by Gartner, and which they refer to as Gartner Magic Quadrants. Gartner Magic Quadrants are a culmination of research in a specific market, giving a wide-angle view of the relative positions of the market's competitors. By applying a graphical treatment and a uniform set of evaluation criteria, a Gartner Magic Quadrant assists in informing an organisation of how well technology providers are executing against their stated vision. Magic Quadrants depict markets in the middle phases of their life cycle by using a two-dimensional matrix that evaluates vendors based on their completeness of vision and ability to execute. The Magic Quadrant has 15 weighted criteria that plot vendors based on their relative strengths in the market. This model is well suited for high-growth and consolidating markets where market and vendor differentiations are distinct. Gartner describe these 15 criteria within two categories; completeness of vision and the ability to execute, which are described as follows:

Completeness of Vision: This reflects the vendor's innovation, whether the vendor drives or follows the market, and if the vendor's view of how the market will develop matches Gartner's perspective, and is comprised of the following;

- ❖ Market Understanding: The ability of a vendor to understand buyers' needs and translate these needs into products and services. A vendor that shows the highest degree of vision listens and understands buyers' wants and needs, which it can shape or enhance with its vision.
- ❖ Marketing Strategy: A clear, differentiated set of messages consistently communicated throughout the organisation and publicised through the Website, advertising, customer programmes and positioning statements.
- ❖ Sales Strategy: A strategy for selling products that uses the appropriate network of direct and indirect sales, marketing, service and communication affiliates to extend the scope and depth of a vendor's market reach, skills, expertise, technologies, services and customer base.
- ❖ Offering (Product) Strategy: A vendor's approach to product development and delivery that emphasises differentiation, functions, methodology and feature set in relation to current and future requirements.
- ❖ Business Model: The validity and logic of a vendor's underlying business proposition.
- ❖ Vertical/Industry Strategy: A vendor's strategy to direct resources, skills and offerings to meet the needs of market segments, including vertical industries.
- ❖ Innovation: Marshalling of resources, expertise or capital for competitive advantage, investment, consolidation or defence against acquisition.
- ❖ Geographic Strategy: A vendor's strategy to direct resources, skills and offerings to meet the needs of regions outside of the vendor's *"home"* or

native area, directly or through partners, channels and subsidiaries, as appropriate for that region and market.

Ability to Execute: This summarises factors such as the vendor’s financial viability, market responsiveness, product development, sales channels and customer base, and which include the following:

- Product/Service: Core goods and services offered by the vendor that compete in and serve the market. This category includes product and service capabilities, quality, feature sets and skills, offered natively or through original equipment manufacturers, as defined in the market definition and detailed in sub criteria.
- Overall Viability: Includes an assessment of the vendor’s overall financial health, the financial and practical success of the relevant business unit, and the likelihood of that business unit to continue to invest in and offer the product within the vendor’s product portfolio.
- Sales Execution/Pricing: The vendor’s capabilities in pre-sales activities and the structure that supports them. This criterion includes deal management, pricing and negotiation, pre-sales support and the overall effectiveness of the sales channel.
- Market Responsiveness and Track Record: Ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the vendor’s history of responsiveness.
- Marketing Execution: The clarity, quality, creativity and efficacy of programmes designed to deliver the vendor’s message to influence the market, promote its brand and business, increase awareness of its products and establish a positive identification with the product, brand or vendor with buyers. This “mind share” can be driven by a combination of publicity, promotions, thought leadership, and word of mouth and sales activities.
- Customer Experience: Relationships, products, and services and programmes that enable clients to succeed with the products evaluated. This criterion includes the ways customers receive technical support or account support. It can also include ancillary tools, customer support programmes (and their quality), availability of user groups and service-level agreements.

❖ Operations: The vendor's ability to meet its goals and commitments. Factors include the quality of the organisational structure, such as skills, experiences, programmes, systems and other vehicles that enable the vendor to operate effectively and efficiently.

The quadrants, areas are; Challengers, Leaders, Niche Players, and Visionaries, which are depicted in Figure 62.

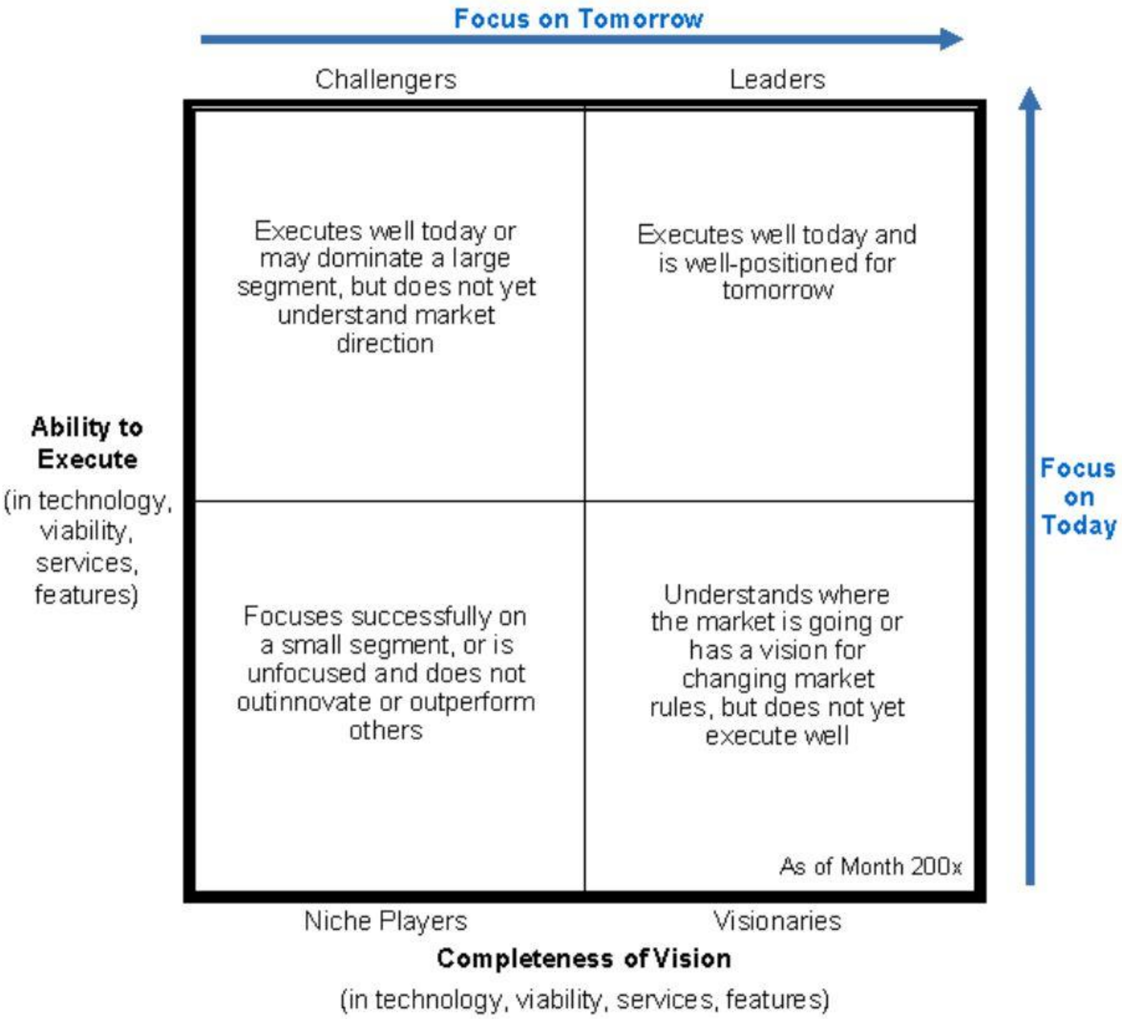


Figure 62: Gartner Magic Quadrant: *Source (Richardson et al., 2008)*

Quite a number of technology driven organisations place a great deal of importance on the relevancy of the Magic Quadrant. The primary concern, relates to, the question of whether they are positioned within it at all, and the secondary concern, then becomes, where are they positioned within it? SAP was particularly pleased to be able to announce in March 2010, that they had been positioned within the leader's quadrant of the Magic Quadrant, for Continuous Control Monitoring, which is illustrated in Figure 63. According to Gartner, "*Within the* *governance, risk and compliance marketplace, Continuous Controls Monitoring (CCM), is a set of technologies that assist the business in reducing business losses from fraud or failure to follow rules governing financial transactions, and improving performance through continuous monitoring and reducing the cost of auditing through continuous audit of the automated controls in ERP systems or other financial applications."* According to the report, *"The CCM market is far from mature, but the leaders in the market have had a significant presence in the market for many years. They all have strong, market-tested CCM for segregation of duties capabilities and offer CCM for transactions. Their CCM for application configuration and CCM for master data capabilities are adequate to support primary functions. When lacking in multiplatform capabilities, they have services and technology partnerships to fill the gap."* This was followed up in July 2011 by a further announcement by SAP that they had now also been positioned within the leader's quadrant of the *"Magic Quadrant for Enterprise Governance, Risk and Compliance (EGRC) Platforms"*. According to Frederic Laluyaux, CFO Line of Business, SAP. "*This leadership position is attributed to the remarkable advances we have made with the 10.0 release of our GRC solutions, the depth of our market understanding, our GRC product strategy, the customer adoption we have experienced in the past year and our customers' successes. SAP provides comprehensive EGRC capabilities that enable our customers to better manage their risk and compliance initiatives, better protect their values and sustainably improve performance"*. The above, along with many other awards and accolades that SAP have received within recent years, serves as a valid justification for the selection of SAP by PDV as its ERP solution provider.

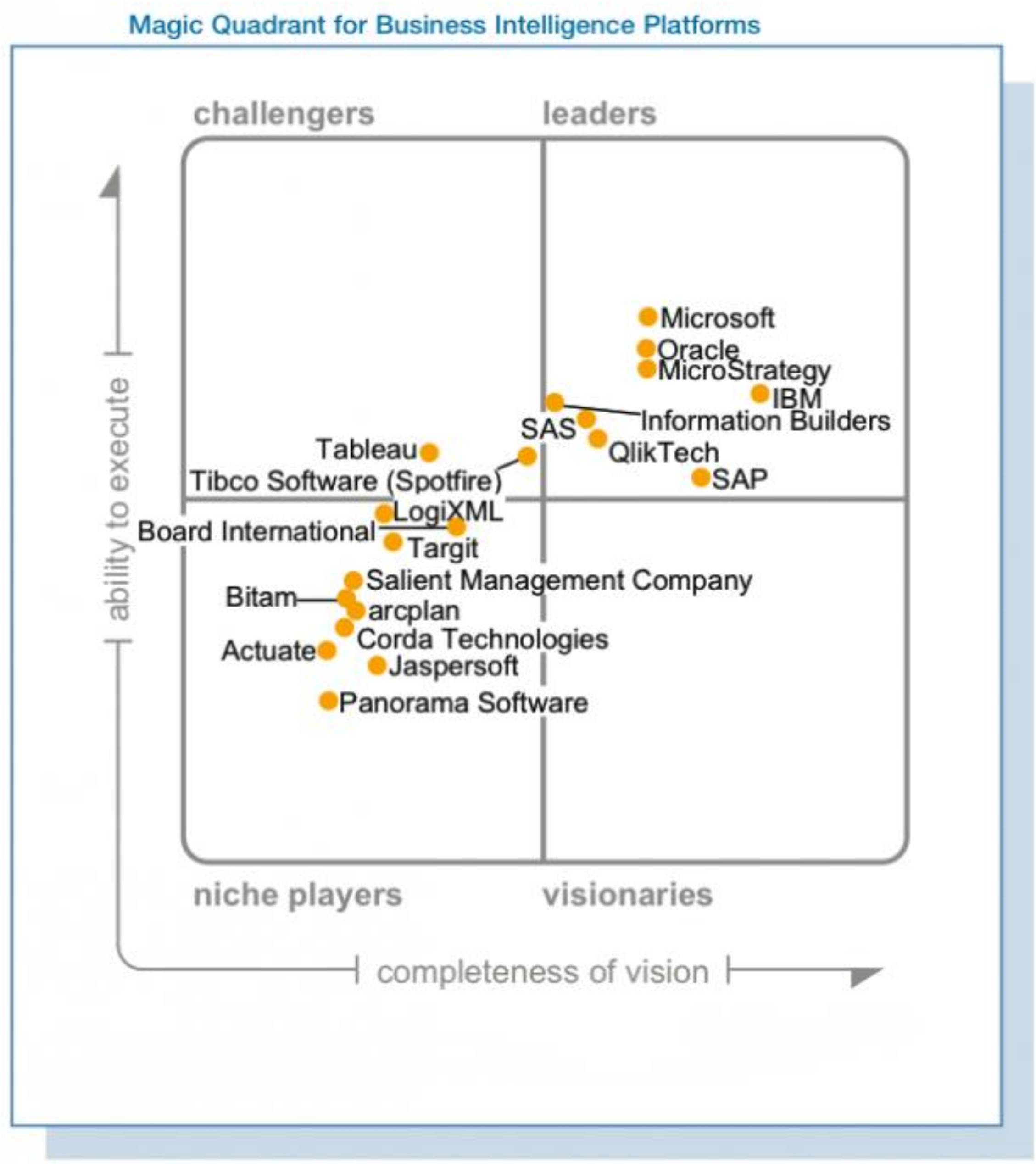


Figure 63: SAP in Leaders Quadrant. *Source: (Richardson et al., 2008)*

7.5. Leveraging the Technology

Changing markets and economies create opportunities as well as challenges for businesses around the globe. The underlying theme for all businesses today is that corporate value is driven by the bottom line, and, in the end, it is profitability that really matters. To achieve high profitability, organisations need to implement strategically driven business performance management solutions that help them make quick, informed decisions and understand the impact of those decisions across the enterprise. According to (Everett, 2003), an American

Management Association survey of 203 companies ranging in size from $27 million to $50 billion indicated that *"measurement-managed"* companies consistently outperform their peers, see Figure 64.

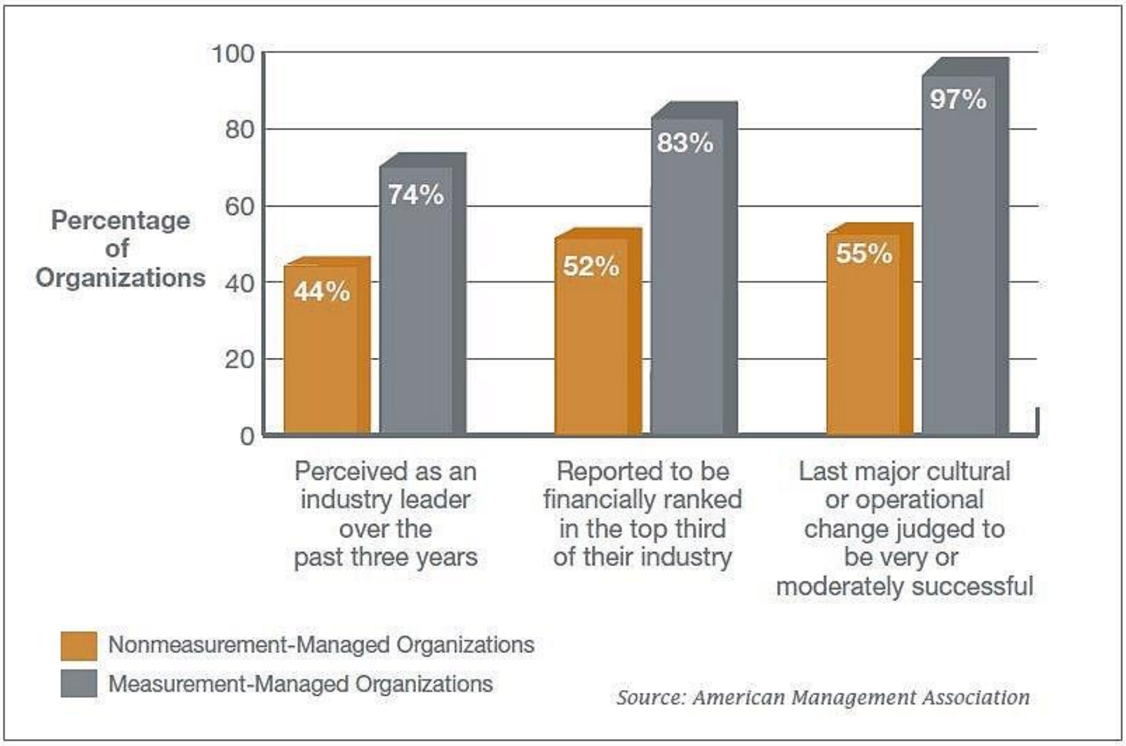


Figure 64: Performance Management. *Source:(Everett, 2003)*

Leveraging this type of strategic thinking coupled with the capabilities offered by the ERP system that was implemented within the organisation, now allowed PDV to more effectively manage business performance through a number of different mechanisms. PDV now had the ability to communicate goals and strategies, business drivers and key performance measures for success. This was now possible because of the ability to dynamically model and test business scenarios, validate strategies and plans, and allocate resources for maximum business impact. This ability proved to be a significant advantage in assisting management to align strategies to operational plans, and align individual goals to corporate objectives. Management now had a much greater level of flexibility available to them because of the ability to adapt plans and budgets in real-time, through the ability to identify and proactively track performance against leading indicators and established metrics for success. This all became possible because of the capabilities of the system to monitor measure and report on performance against goals across the extended supply chain, as well as the ability to create and sustain an environment for continuous performance improvements. All of these factors combined together, resulted in what (Nelson and Wright, 2005), refer to as the fundamental value of BI, which is to provide a single version of the truth through a central data repository from which to conduct strategic analyses, rather than having to draw on data from many disparate sources. However, as with many things to do with BI, the trend is always to provide it "*faster*". In effect, this means *"getting the right information, to the right people, exactly when they need it"*.

A particular case in point can demonstrate how the synergy offered by the system was able to provide additional capabilities within the organisation. At one point in time, both the marketing and sales managers had become aware of declining volume sales over the previous two quarters. Through analysis of the available data, it was established that there was a statistically significant correlation between the declining sales and declining marketing activities. The marketing department was then able to query the BI system to establish how effective were past marketing campaigns at increasing sales by product, by customer segment and by marketing channel. It was then possible to further refine the queries by establishing the demographics of the customers that responded to the marketing campaigns and, also, what marketing channels were most effective for each segment. Coupling this information with historical data about sales volume over the previous 24 months, including seasonal trends, it was then possible to use this information in conjunction with the projected effect of proposed new marketing campaigns to forecast sales volume for the next six months. This proved to be a highly effective technique, and through its application, it very quickly brought about the desired change of returning sales volume to the previously established targets.

7.6. Objective 2

To investigate the role of BI in facilitating organisations in their efforts to achieve external competitive advantage and the extent to which organisations are leveraging the synergy that, BI solutions can offer.

Important as the internal environment is, the external environment is no less so. No matter how well aligned the internal resources are in relation to the organisations competitive strategy, external forces can be detrimental to the success of a business and even threaten its very survival if they are not encountered and considered in a very comprehensive way. Organisations are not only political systems; they are also open systems dependent on exchanges with their environments (Katz and Kahn, 1978), and most organisations are dominated in some way by their environments. The forms of domination differ, but they always involve the environment's control over scarce resources and are problematic in some way. It is argued by (Lawrence and Lorsch, 1967), that one or two *"dominant environmental requirements"* typically dominate any one industry's landscape. Such requirements could include technological uncertainty, regulatory demands, raw material shortages, or supply-demand imbalances. From a BI perspective, it is now well recognised that the Internet has changed the very nature of opportunities and threats that organisations are now exposed to from within the external environment. A number of technological forces represent major opportunities and threats that have to be taken into consideration when formulating strategies, are illustrated in Figure 65.

Figure 65: External Environmental Forces. *Source:(Gupta, 2009)*

Technological advancements can have a dramatic effect on an organisation's products, services, markets, suppliers, distributors, competitors, customers, manufacturing processes, marketing practices, and competitive position. Technological advancements can create new markets, which can result in a multitude of new and improved products, which have the effect of changing the relative competitive cost positions within a given sector, and render existing products and services redundant. Technological changes can reduce or eliminate cost barriers between businesses, create shorter production runs, create shortages in technical skills, and result in changing values and expectations of employees, managers, and customers. Technological advancements can create new competitive advantages that are more powerful than existing advantages. No company or industry today is insulated against emerging technological developments. Within many industries, identification and evaluation of key technological opportunities and threats can be the most important part of the external strategic management audit. According to (Gilad *et al*., 1988), BI can be defined as the process of monitoring a firm's external environment to obtain information relevant to its decision-making process. Within this context the BI process consists of a series of activities that involve identifying, gathering, developing, analysing, and disseminating information (Vedder *et al*., 1999). One of the important steps in the process is to identify the customers, suppliers, competitors, stockholders, public-interest groups, political parties, governments or other variables in the environment to be monitored (Schermerhorn Jr, 2010). With the accelerated growth of the Internet in recent years, a great deal of this information can now be accessed via the Web. As many organisations share common interests, they often have hyperlinks pointing to each other. These, together with the Web pages most popular among them, form the Web communities of the firm or the market of interest. Web communities thus have become a very important component in business intelligence analysis in the Internet age and have been investigated in previous BI research (Reid, 2003).

With regard to the external environment, Michael Porter has described a category scheme consisting of three general types of strategies that are commonly used by businesses (Porter, 1998). These three generic strategies are defined along two dimensions: strategic scope and strategic strength, which is illustrated in Figure 66. Strategic scope is a demand-side dimension and looks at the size and composition of the market you intend to target. Strategic strength is a supply-side dimension and looks at the strength or core competency of the firm. In particular he identified two competencies that he felt were most important; product differentiation and product cost. According to Porter, a firm's relative position within its industry determines whether a firm's profitability is above or below the industry average. The fundamental basis of above average profitability in the long run is sustainable competitive advantage. There are two basic types of competitive advantage a firm can possess: low cost or differentiation. The two basic types of competitive advantage combined with the scope of activities for which a firm seeks to achieve them, lead to three generic strategies for achieving above average performance in an industry: Cost leadership, Differentiation, and Focus. Cost Leadership is a strategy, by which a business offers an average product at a low cost to the broadest possible market. Economies of scale result in cost savings, partially passed to consumers.

- Cost Focus is a strategy, by which a business offers an average product at a low cost to a specific customer group. Customer relationship largely depends on the cost of the product and a unique connection with a customer.
- Product Differentiation is a strategy that focuses on offering a unique product to the broadest possible market. The product offering necessitates continuous innovation in light of the highly competitive market forces.

The Focus Strategy has two variants; Cost Focus and Differentiation Focus. Differentiation Focus is a strategy that focuses on offering a unique product to a specific customer group. The customer relationship largely depends on the uniqueness of the product and the way the customer is being served. Cost Differentiation is the most difficult strategy to attain. It requires offering a unique product at a low cost to a relatively broad market. This strategy creates the highest benefits and is consistent with the *"Blue Ocean"* strategy, a strategy that reinvents its market place and competes in entirely new dimension.

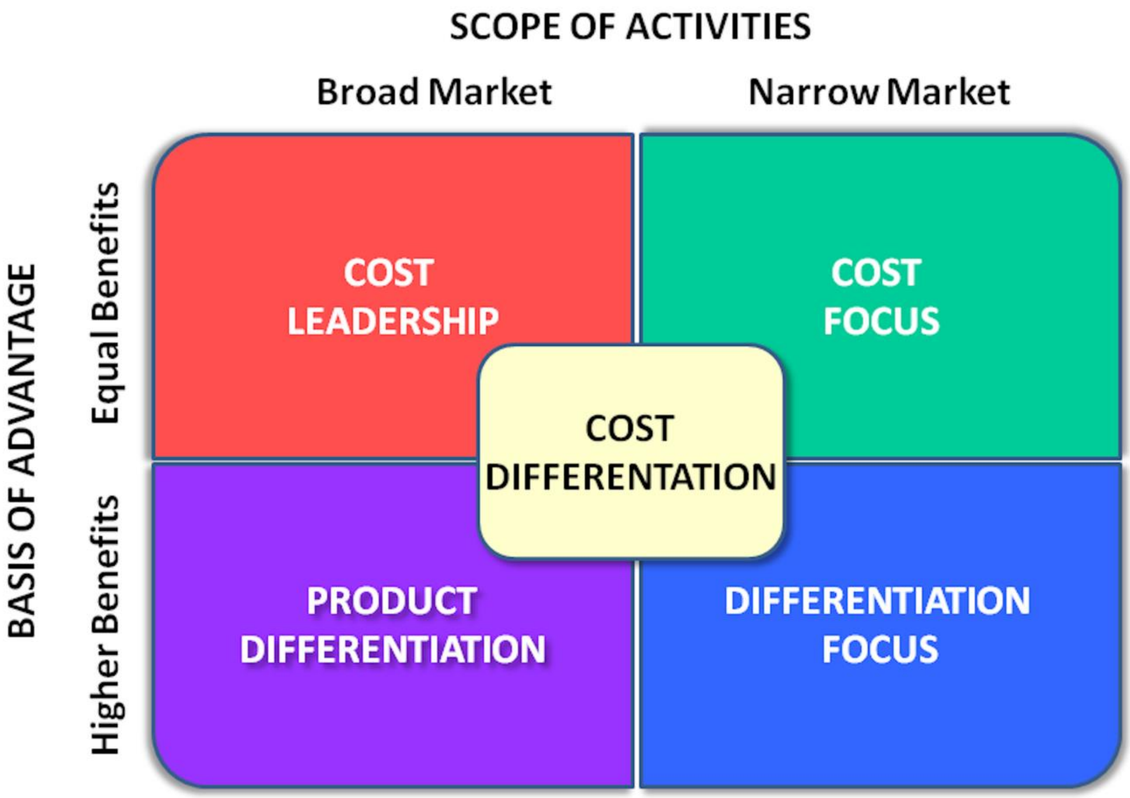


Figure 66: The Strategic Framework. *Source:(Montreuil et al., 2000)*

It was considered within PDV that the pursuit of cost leadership was an important strategic goal, and it was the intent of PDV to provide this cost leadership, through both a low cost and best value strategy. PDV were very aware that due to the nature of the market that they were operating in, that pursuing a strategy of being a low-cost producer within their particular sector was one that would lead to a higher probability of success due to the fact that the market was composed of many price-sensitive buyers, and that there was only a limited number of ways to achieve product differentiation, when buyers do not care much about differences from brand to brand, or when there are a large number of buyers with significant bargaining power. The BI system within PDV proved itself to be a key tool which could be used to enable it to undercut competitors and thereby gain market share and sales.

7.7. In Store BI Technologies

PDV introduced a number of cutting edge technologies into its stores in order to maximise the potential of the financial return of each customer visit. Along with a range of other BI solutions, it introduced the Personal Shopping Assistant (PSA), which consists of a touch screen tablet PC with built-in wireless connectivity to support mobility. Like a Tablet PC, the

PSA does not have a separate keyboard. Consumers can attach the PSA on top of their shopping cart, which they can then use while shopping in the store. The PSA helps in addressing the challenge of effectively providing high quality personalised customer service during the shopping experience. The PSA promises to change this by providing consumers with a *"personal shopper"* that accompanies them on their shopping trip and provides them with personalised assistance when it is required. The PSA utilises wireless connectivity to provide mobility. A radio built into the PSA transmits a wireless signal based on the 802.11 standard to an access point equipped with an antenna and connected to the regular wired network. Wireless access points deployed throughout the store ensure that the PSA can connect anywhere. Using standard browser based technology the PSA can access the existing content that PDV has already developed for their website. Another technology that PDV introduced was Digital Advertising Displays (DAS). These digital devices consist of flat screen displays connected either to the Local Area Network (LAN), or by the use of wireless technologies. Yet, another innovation introduced into this sector of operations, was the introduction of Electronic Price Tags (EPT). This technology introduces a number of benefits, both for the customer and the company. Changing prices on products manually is a very costly exercise, and this technology can lead to significant cost savings after the initial investment. Therefore, electronic price tags contribute to price accuracy in stores, which can assist in reducing the number of possible unpleasant exchanges between the consumers and store personnel, by providing a higher probability that the consumer is charged the correct price for any purchased products. Prior to the introduction of EPT, price inaccuracy was estimated to be as high as 3 per cent of the items held in store. The use of this technology allows prices to be changed much more frequently and through the touch of a keyboard. This ability supports one of the key tenets of supply change management, in that it allows the pricing of items within individual stores to be changed independently, the price at any given time being based on the accumulated costs of bringing the item to its end distribution or terminal point. This gives rise to a situation where the same item may be on sale at different prices at different distribution outlets on the same day, but this makes perfect sense, as the pricing is reflecting the different supply chain costs at the different locations.

Within chapter five, it was demonstrated how PDV had arranged their online portal to gather as much information about visitors to the site as possible. However, research has demonstrated that many people use websites to garner information about the possible products that they wish to buy, and then they prefer to go to an outlet to make a purchase, armed with the information that they have gained from their browsing activities. It is within this phase that additional benefits from the BI system can be brought to bear. If this customer is a frequent visitor to the store, it is very likely that this person will have been issued with a loyalty card by PDV. Through the use of RFID technology, the customer's presence is detected, shortly after the customer enters the store, this information is then transmitted to assistants within the store. Information concerning items that the customer previously viewed on the PDV Website is now downloaded to the assistant's Personal Digital Assistant (PDA). The assistant is now able to approach the customer, introducing himself using the customer's first name and armed with knowledge in relation to the items that the customer is likely to be interested in. As the customer passes through the store, the customer's presence continues to be detected by the chip on the loyalty card, and messages are instantly changed on nearby advertising displays, which are based on the customer's previous purchasing and Web browsing activities on the PDV Website. The customer can now exit the store without approaching any checkout point. Any items removed from the shelves and placed in the shopping basket during the visit to the store, are again automatically detected through the use of RFID technology, and these items are automatically charged to the customer's account.

7.8. Objective 3

To gain an understanding of the drivers and barriers for organisations who wish to employ BI technology.

Drivers imply pressure and motivation to adopt. The (Business Dictionary, 2009), defines *"drivers"* as: People, knowledge, and conditions (such as market forces) that initiate and support activities for which the business was designed (Khan *et al*., 2009). A White Paper by (Microsoft, 2010), provides a slightly different perspective: *"A Business Driver is a brief statement that defines clearly and specifically the desired business outcomes of the organisation along with the necessary activities to reach them."* There are quite a number of drivers within the BI domain. The Business Pressure-Responses Support Model postulates that there are four components that put pressure on organisations from the external environment. According to (Turban *et al*., 2008), these drivers include:

- Market related factors such as competition.
- Consumer demand elements such as speed of delivery.
- Technology inputs such as innovation.

- Societal pressures such as government regulation.

These are representative of the drivers that are common across many businesses. A more focused set of BI drivers include items such as; organisational strategy and goals, commitment to profitability, and shareholder value maximisation. Organisational commitment in fact is the key element for an innovation to be adopted and subsequently used (Ramamurthy, 2007). This includes two aspects. Is there support and buy-in from senior management? And second, is their vision building at the senior management level? BI adoption is higher if all the stakeholders are on board from the onset of major projects. A Database and Network Journal article *"Demand for BI Technology Set to Soar"*, predicts that the BI license revenue market will double in 2012 to $8 billion growing at a compound annual growth rate of 12.5 per cent. The study attributes the positive future outlook of BI to the digital enterprise phenomenon as the main driver behind this growth rate (Khan *et al*., 2009). Along with these findings, the Centre for Research in Electronic Commerce, University of Texas at Austin, conducted a large-scale study to assess e-business value in small, medium, and large companies across the US and Europe. This study, which was sponsored by Dell Computer, identifies the critical links between e-business drivers, financial indicators, and operational excellence measures. To maximise benefits, a company should invest in and commit resources to all eight of these drivers:

- System integration.
- Customer orientation of IT, informational and transactional.
- Supplier orientation of IT, informational (quality, supply continuity, and relationship management) and transactional.
- Internal orientation of IT.
- Customer-related processes.
- Supplier-related processes.
- Customer e-business readiness.
- Supplier e-business readiness.

The overall findings from this survey suggest that high performers invest more effort and resources in these e-business drivers than companies who have not benefited from e-business. Moreover, although many companies investing in e-business initiatives have enjoyed financial benefits, several companies either have not engaged in e-business or are just beginning to transition to it (Barua *et al*., 2000). Although, senior managers may ultimately judge the success of e-business by financial indicators, drivers related to information technology, business processes, and the company's external environment are key ingredients. IT-related drivers include the level of integration between online and back-office applications, and informational and transactional capabilities of online systems. Business-process drivers include standards and procedures for interactions with customers and trading partners. An external environment conducive to e-business success depends on the readiness of customers and suppliers. By choosing the levels of appropriate e-business drivers, companies can achieve operational excellence in day-today operations. Operational excellence measures include the extent of business conducted online, the extent of Maintenance, Repairs, and Operations (MRO), and production goods procured online, the percentage of customer service requests resolved online, and order delivery cycle time.

7.9. Customer Behaviour

In the marketing literature, many studies have proposed or verified that perceived customer value is an important determinant of consumers' purchase intentions and purchase decision making, and in understanding consumer behaviour (McDougall and Levesque, 2000). While value considerations typically have been associated with the overall pre-purchase assessment of the utility of a product, (Anckar, 2003), makes the point that the core idea of the concept is equally relevant when one examines the relative advantages of technological innovations, commercial media, or even electronic distribution channels. Within this context however, the traditional view of the value equation as a trade-off between benefits and costs is too simplistic in terms of building an understanding of the primary motivators and inhibitors to e-commerce adoption. Instead, the value concept should be interpreted as the trade-off between get and give components described not only in monetary terms, but seen from a much broader perspective, addressing non-monetary expenditures as well (Eggert and Ulaga, 2002). Therefore, consumers, acting rationally, make their channel adoption/rejection decisions based on their perceived channel net value, which is seen as the trade-off between the overall benefits that are likely to accrue by using electronic channels in comparison to existing alternatives, and the overall barriers encountered to using them or to deriving the sought benefits. The e-commerce literature has identified and extensively discussed, especially in the early years of the commercial Internet, a large number of consumer motivators and impediments to e-commerce, these factors are listed in Tables 8 and 9.

Benefits
Accessibility and convenience. The possibility to shop anytime, from anywhere is the most obvious and most commonly cited advantage of e-commerce, and was found to be the most important perceived consumer benefit of Internet shopping in empirical studies by (Jarvenpaa and Todd, 1996) and (Kangis and Rankin, 1996).
Global choice. Since the boundaries of e-commerce are not defined by geography or national borders, consumers will benefit from a wide selection of vendors and products - including a wider availability of hard-to-find products (Benjamin and Wigand, 1995, Hoffman *et al*., 1995, Alba *et al*., 1997).
Online delivery. For digital products, the whole commercial cycle, including distribution, can be conducted via a network, providing instant access to products immediately when a need arises.
Test and trial online. Digital products can be tested over the Internet prior to making purchase decisions, reducing uncertainty.
The real-time nature of the medium. The Internet can provide consumers with up-to-the minute information on prices availability, etc. (Franz, 2000).
Time savings. Consumers may benefit from the shopping process being faster in the market space than in the marketplace as a result of the rapidity of the search process and the transactions (Wigand and Benjamin, 1995, Krause).
Possibilities for comparison shopping. By allowing consumers to shop in many places and conduct quick comparisons of offerings and prices (Hoffman *et al*., 1995, Hart *et al*., 2000), Internet marketplaces have the ability to reduce search costs for price and product information (Bakos, 1998, Strader and Shaw, 1999, Rowley, 2000, Bhatt and Emdad, 2001).
Access to extensive information. An important consumer benefit is the access to greater amounts of dynamic information to support queries for consumer decision-making (Hoffman *et al*., 1995, Alba *et al*., 1997).
Privacy and anonymity. The Internet has the potential to offer consumers benefits with respect to a partial, or even a total privacy and anonymity throughout the purchasing process (Parsons, 2002).
Competitive prices. By embracing e-commerce consumers may benefit from price reductions as a result of increased competition as more suppliers are able to compete in an electronically open marketplace (Turban *et al*., 2004), as a result of reduced selling prices due to a reduction in

operational/transaction costs (Brynjolfsson and Smith, 2000), and manufacturers internalizing activities traditionally performed by intermediaries (Benjamin and Wigand, 1995).

Availability of personalised offerings. Consumers can benefit from IT-enabled opportunities for personalized interactions and one-to-one relationships with companies, which allow for products, services and Web content to be customized more easily (Peppers and Rogers, 2002, Brown, 2000).

The asocial nature of the purchasing process. Since consumers differ in their social disposition, many customers may find an impersonal purchasing situation desirable for asocial reasons or simply because they find the verbal contact with a seller time-consuming. Moreover, the lack of physical sellers creates a sales setting where there is virtually no pressure to buy (Zellweger, 1997).

Table 8: Summary of the potential benefits to the adoption of e-commerce *Source: (Anckar, 2003)*

Barriers
Quality evaluation. On the Internet, it is more or less impossible to make sure, beyond doubt, that (tangible) products have the desired features (e.g. design, material, colour, fit), giving rise to a quality evaluation barrier to e-commerce. Empirical findings by (Kangis and Rankin, 1996), showed that the need to feel and touch was the dominating disadvantage for all home-shopping services.
Security risks. It has been suggested that transaction security (such as the credit card number being picked up by third-party hackers) is mostly a perceptual problem in e-commerce (Rose *et al*., 1999). Nevertheless, the fact remains that it may be one of the more complex barriers to be overcome (Zwass, 1996, Aldridge *et al*., 1997, Reedy *et al*., 2004), as studies show that adopters as well as non-adopters of Internet shopping have security worries (Furnell and Karweni, 1999, Fenech and O'Cass, 2001).
Lack of trust in virtual sellers. The fear of fraud and risk of loss has commonly been cited as a significant barrier to B2C e-commerce, with empirical research findings supporting this assumption (Jarvenpaa and Todd, 1996, Hoffman *et al*., 1995, Vijayasarathy and Jones, 2000).
Delivery times. In tangible product categories, any home-shopping method involves delivery times, which means that the Internet is at a disadvantage to physical stores as it fails to meet the customers' need for instant gratification (Vassos, 1996). Consumers may thus be reluctant to wait for the delivery of ordered goods for days/weeks if the same product can be collected immediately in physical outlets.
Lack of personal service. While e-commerce offers great opportunities for one-to-one marketing, it significantly reduces, or even puts an end to the personal service (human-to-human contact)

characterizing traditional commerce. This may, as suggested by research by (Kangis and Rankin, 1996), be an impediment to e-commerce for many consumers.
Lack of enjoyment in shopping. Many consumers find the shopping experience - looking, feeling, comparing - in retail stores relaxing and enjoyable (Jones, 1999). As the feeling of amusement and relaxation is unlikely to be as marked in electronic settings, e-shopping can hardly be seen as a substitute for the leisure experience associated with conventional shopping (Phau and Poon, 2000).
Hard to find what you are looking for. The difficulty to locate stores/products/information on the Web (Jarvenpaa and Todd, 1996, Rose *et al*., 1999), emerges from limitations of the user, search engines used, or poor site usability.
Time-consuming nature. As noted, e-commerce may offer consumers savings in time. In practice, however, using the Internet for commercial purposes may prove to be too time consuming for many users (Anckar and Walden, 2001). There are multiple reasons for this: (i) difficulties locating Websites/products/services (Hofacker, 2001); (ii) registration procedures required to access services; and (iii) making price comparisons (Reedy *et al*., 2004).
Cost of entry. Cost of acquiring a computer, etc.
Cost of use. Internet access fees.
Limited Internet/computer experience. Reluctance/difficulties operating computers and/or browsing the Web.
Poor connection speed. Due to low bandwidth connections, using the Internet may be time consuming, and thus frustrating.

Table 9: Summary of the potential barriers to the adoption of e-commerce *Source: (Anckar, 2003)*

The research conducted by (Anckar, 2003), had the twin objectives of establishing the relationship between e-commerce adoption and consumer perceived channel net value, and to gain an understanding of the primary drivers and inhibitors to e-commerce adoption. Different consumer groups in terms of Internet and e-commerce adoption had, by necessity, to be investigated and compared. A mail survey was conducted to target different consumer groups in terms of their level of experience with electronic media. The two dimensions of consumer e-commerce adoption which were drawn on in this study were; Internet adoption, and adoption of Transaction-based E-Commerce (TEC). The corresponding subsamples were operationalized as follows:

- Internet non-adopters: respondents who have never used the Internet.
- Internet adopters: respondents using the Internet regularly or occasionally.

Internet adopters have experiences of the Internet, but not necessarily of online shopping, this consumer group was further split into: TEC non-adopters: Internet adopters who for various reasons have not yet embraced online shopping. TEC adopters: Respondents who have made purchases on the Internet, and whose statements are therefore, based on their experiences with online shopping. With respect to the significance of the different drivers and inhibitors, the findings of this research were in line with the results of previous, related studies (Kangis and Rankin, 1996, Jarvenpaa and Todd, 1996, Furnell and Karweni, 1999), in the sense that accessibility and convenience was perceived as the single most important benefit by the respondents, with 80 per cent agreeing or strongly agreeing to the statement that this was an important motivator for using the Internet for commercial purposes.

By leveraging these drivers within PDV, the organisation was able to exploit BI, the Internet and other technologies to substantially improve both their customer and supplier relationships. PDV through the use of these technologies was able to make significant progress in orienting the IT applications to both customers and to suppliers. Strategies within PDV were aligned so as to provide improved customer orientation measures, which included; providing a high level of communication to customers, through a number of different channels, and also by providing for transactional features for customers to place and manage orders online. This was achieved by providing customers with product information, customer service, ordering services, and customisation, through the secure Website where customers can submit or modify orders, learn about order status, and make payments. A great deal of thought went into providing a Website that would enhance customer experiences, by providing a very personalised content to individual visitors to the site, and by also allowing customers to track their order status after purchase. These measures resulted in increased financial returns, from increased revenues per employee, resulting in a much improved ROI. At the other end of the supply chain, substantial benefits were also achieved in relation to suppliers. Again, online applications were oriented toward suppliers and vendors to share quality information provide feedback, and process order changes via the Web. Suppliers were allowed access to certain parts of the PDV data warehouse, where they could establish inventory levels, product schedules, and product road maps along with additional information to manage and maintain supplier relationships.

7.10. *The Barriers*

Quite a number of BI initiatives have failed because the tools weren't accessible enough to the end users, which led to a situation where the full BI capabilities were never really applied. Users daunted by the complexity of the systems, often simply used the BI system to pull data from the data warehouse and import it into Microsoft Excel, bypassing the system's analytic capabilities that, to them, seemed overly complex, difficult to comprehend, and overall not very useful. As BI evolves, new technologies are blurring the lines between desktop applications like Microsoft Office and the back-office systems that hold the data. This is enabling end users to access BI information as part of their day-to-day application and desktop environment, in a context that makes sense to them, which removes the most significant barrier to BI success. Organisations can use the lessons learned from past efforts to uncover the guidelines and best practices that help ensure success in future BI initiatives. Barriers *"restrict"* while drivers *"encourage"* organisational adoption of IT systems (Chaffey and Smith, 2008). In the BI Guide (BRAC, 2009), an aggregation of all accumulated research papers on BI, points out that even though BI is the most highly desired technology spanning a $10 billion a year market and growing at 10 per cent a year, it still suffers from a *"relative inability to prove its value*". The guide goes on to state that the main barriers to BI adoption are *"cost and complexity"*. This is further compounded by the fact that a 2007 study by Information Week cited in the Guide reveals that in a survey of 388 business technology professionals, over 30 per cent of respondents claimed that BI vendors were *"unable to demonstrate the benefits of BI to internal stakeholders"*.

Most companies considering BI are beleaguered by issues which can be attributed to a *"specific"* business unit. The resulting BI initiative then creates business silos which prevent cross company examination of data sets residing in disconnected IT systems. This lack of cross organisational data analysis capability is explained by the fact that there is no single vendor that excels in all areas of BI, leaving it up to the customer to pull together various business components. The result is that client organisations excel only in their specialty areas such as; in managing customer churn, or in predictive analytics. The Guide (2009), further notes that 40 per cent of the cost involved in developing sophisticated analytics and modelling for BI projects comes from *"moving data between systems"*. This means that data migration and integration becomes the single most potent *"barrier"* to BI adoption. Additional barriers which have been identified in the literature are as follows:

- ❖ Departmental silos remain the biggest barrier to data sharing.
- ❖ Data access and access to clean data.
- ❖ Employee resistance to adoption of new technology.
- ❖ Lack of CIO participation in decision making process.
- ❖ Usability verses feature mismatch: too many feature too few being used.
- ❖ High investment in costly metadata management.
- ❖ The expense of BI consulting.
- ❖ Costs associated with licensing, upgrades and maintenance.

PDV were well aware of the negative impact that these barriers could have on the success of its overall BI programme. It therefore, implemented a number of procedures and programmes to mitigate these affects along the following lines. It took great care in being selective about the BI programmes that it choose to use, and only bought those which could be clearly identified as contributing "*Added Value*" to the organisation. These included applications that could enact as enablers, such as those used to integrate, publish and analyse enterprise data across disparate databases, without expensive ETL technology. A substantial cost that can often be associated with a BI solution is; that cost which is associated with metadata, because of the requirement to distil the useful information from the mass of information available. By leveraging the company's existing metadata, it was possible to reduce the costs associated with this part of the implementation quite considerably.

Costs associated with the use of consultants, and also the roles that consultants play in BI programmes can be problematic. A number of BI solutions require substantial consulting programmes as part of their launch process, often costing as much as the software itself. PDV took the decision from the very outset of the BI programme to limit the involvement of consultants throughout the entire lifetime of the programme. In instances where the use of consultants was required, the duration and the associated cost of the consultancy was kept to an absolute minimum. Also, use was made out of specific software that could be employed without the need for expensive consulting, this software could be installed relatively easily and could provide access to any combination of enterprise databases in a single user request, and included user-friendly tools for query creation, reporting and data analytics. A critical success factor in this regard was the selection of SAP as the principle ERP supplier. SAP were very quickly able to ascertain their credentials by identify and aligning with the organisational needs of PDV. With all these components in place, it provided PDV with the ability to move beyond viewing customers, workforce, supply chain or finance as separate entities, and provided the ability to consider all the core elements of the business as a single, integrated whole. This resulted in a system that enables PDV to measure the accuracy and success of their goals and objectives from various perspectives, and make intelligent decisions based on quantifiable analytics. SAP of course was not used in isolation.

PDV implemented a mix of expertise that included database structure, ETL, design, end-user tools, and security. All of these tools working in combination were able to ensure timeliness and accuracy of the data while the use of Web and Windows-based tools that were already in place assisted in driving user adoption. Also, by integrating server and desktop environments like SQL Server, SharePoint, and the Microsoft Office System, these all helped to accelerate the overall enterprise reporting initiative. By employing all of these techniques PDV were able to surmount many of barriers that are normally associated with BI system implementations, which greatly enhanced the ability of the BI system to contribute to the organisations strategic needs and objectives. Prior to embarking on this combination of BI initiatives within PDV, their contribution to the individual programmes, although expected to be positive was not exactly quantifiable at that time.

The introduction of BI into PDV presented quite a number of challenges for the organisation across a diverse range of disciplines. However, due to the skill of all the personnel involved throughout all phases of the programme, every part of the different aspects of the programme was able to contribute, to add a synergy to the system, which was much greater than any of the individual contributions. It has been demonstrated through this thesis that BI, apart from enhancing the overall organisational capabilities within an organisation, can also have a significant effect on an organisation's knowledge-creating capabilities. It was also demonstrated that the introduction of routines of *"best practice"* via ERP and BI had unanticipated consequences for knowledge-creating activities at management and operational levels that challenged the knowledge sets on which unit-specific core capabilities were based. The dynamic reporting capability of the ERP system to make ad-hoc inquires, to drill down, and to examine managerial and operational performance in greater detail than ever before contributed to the creation of a rigid, centralised management structure and further reduced the autonomy of plant managers and operational staff. This brought about a shift in emphasis from tacit to explicit knowledge and changed the system of values and norms within the organisation.

7.11. *The Psychology of BI Integration*

Industrial psychology has been for many years concerned with identifying individual differences predictive of differential performance on different jobs. The traditional approach was to find the right people, and fit them to the job (David and David, 2009). However, this strict approach tends to under emphasise the fact that the worker is part of a system that also includes equipment, the work space, and the environment in which the work is performed. Thus, often the solution involved in fitting the right people to the job requires redesigning the workplace to accommodate the capabilities of the worker. One of the challenges for designers of automated systems is the allocation of function between human and machine components of the system (Greer, 1989). The ideal system design allocates to humans work that is characteristic of human beings (such as reasoning, decision making, and certain sensory and perceptual skills), and to machines work that is better performed by machines (such as performing highly repetitive functions).

Although industry-wide statistics are difficult to obtain, it is estimated that well over half of the technology initiatives in organisations fail to achieve their stated goals (Toffler, 1980). Given that the people responsible for implementing the vast bulk of these projects are experienced professionals who have a good sense about what they are doing, and that they are normally supported by an experienced workforce, how is it that this failure rate is so high? Although ERP programmes and BI solutions are by their very nature, technology orientated, the truth is that they require people to be able to make them work. This aspect of IT implementation is sometimes forgotten, or simply overlooked. This can result in a situation whereby managers approach projects in a linear, mathematical way, and they fail to take account of the psychological processes associated with people and helping people change. It is the lack of appreciation of the skill sets that are, both required, and that need to be implemented by managers that can lead to the demise of what, with a little bit of care and attention to this aspect of the programme, might otherwise have produced a much more successful outcome. Technology diffusion, adoption, and acceptance each refer to overlapping aspects of the human dynamics by which new products and systems become embedded in the social and business processes of organisations (Guile, 1998). A widely used model of technology acceptance, the Technology Acceptance Model (TAM), predicts individuals' intentions to use a technology system based on a set of belief and attitude variables that include perceived usefulness and perceived ease of use. Developments by organisational theorists suggest that events and emotions in organisations play important roles in influencing employees' attitudes and behaviour.

There is also a growing body of literature about the role of emotion in IS adoption that recognises the complexity of the relationship between them (Delors, 1998), outlined social defences, that employees use to reduce anxiety related to change. (Moon *et al*., 2005), found that individuals receiving a negative intervention on mood caused a decrease in intrinsic motivation and diminished the likelihood of using the focal technology. It could be argued that everyone is always in *"some sort of mood."* From a practical perspective, events in one's day-to-day activities, including those that occur in the workplace, can trigger or sway people's moods into more positive or negative mood states. Motivation has been identified as a key determinant of behaviour in a wide variety of domains (Denning, 2001). Two broad classes of motivation: intrinsic and extrinsic, have been defined and examined across a variety of contexts and studies. Intrinsic motivation refers to the pleasure and inherent satisfaction derived from a specific activity, while extrinsic motivation emphasises performing a behaviour because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity such as increased pay and improved job performance (Blocker, 2005), therefore, both intrinsic, and extrinsic motivation, influence an individual's intention to perform an activity as well as actual performance. In research conducted by (Sambrook, 2003), they state that; The common sense ways of differentiating between mood and emotion on the basis of labels such as *"feeling blue"* or *"really angry"* can be supplemented by comparing two characteristics of affect:

- Duration.
- Object.

Moods have long durations measured in hours or days, whereas discrete emotions have shorter durations measured in seconds or minutes. A number of prominent psychologists (Pan and Lee, 2003, Abadi, 2009, Stedman, 1999), suggest that people have a number of fundamental needs, including those pertaining to growth and development, on the one hand, and those referring to safety, protection, and security on the other.

Regulatory Focus Theory (RFT) suggests that the hedonic principle of approaching pleasure and avoiding pain operates differently, depending on the needs that people are trying to satisfy. Growth and development needs predominate for those who are promotion focused, whereas, security needs drive those who are prevention focused (Pumphrey, 2003). The experience of emotion in response to environmental conditions differs depending upon one's regulatory focus, which has both a stable individual difference component and a situational component. Prevailing conditions shift one's regulatory focus depending upon whether one sees the likely outcome of a situation as a gain or a loss. RFT analyses motivation and emotion as they relate to two sets of universal needs that people have:

- Growth and development needs.
- Security needs.

The theory distinguishes between conditions that can generate positive emotions as a result of gains, and conditions that can create negative emotions resulting from losses. In any given situation individuals take on one of two motivational orientations; promotion focus, which is all about the pursuit of an ideal goal, or prevention focus, which concerns avoiding or averting unpleasant outcomes. The experience of emotion in response to environmental conditions differs depending upon one's regulatory focus, which has both a stable individual difference component and a situational component. Prevailing conditions shift one's regulatory focus depending upon whether one sees the likely outcome of a situation as a gain or a loss, but (Pumphrey, 2003), also suggests the existence of a stable trait that predisposes some people towards one focus or the other. Substantial support for RFT has appeared in a variety of areas, including the effect of regulatory focus on creativity (Davenport, 1998a).

Another theory, Affective Events Theory (AET) has been proposed by (Slater, 1998). AET offers a model of emotional experiences that sees workplace events as the cause of emotional experiences and identifies time as a key factor in the relations between events, emotions, evaluations, and behaviour. The structure of affect is an important determinant of behavioural implications. Affective experiences include both moods, which impact how one interprets an event, and emotions, which constitute the reaction to a specific event. Emotions tend to be shorter in duration yet more intense than moods, and at sufficient intensity they directly and immediately impact thought processes and behaviours. AET suggests that features of the work environment can often lead to workplace events or *"shocks"* of a certain type in the workplace, to which the employee displays an emotional response. An employee's emotional response leads to subsequent behaviour, either immediately during the experience of intense emotion (affective driven behaviour), or much later after things have cooled down and solidified into an attitude toward the event. An interesting outcome from this research revealed that positive and negative emotional events are not simply mirror images of each other. (Choudhary, 2007) notes, that positive affective reactions to workplace events predicted increased organisational commitment and helping behaviour but, negative affective reactions did not predict reduced organisational commitment. Although, AET does recognise that different emotions have distinctive consequences, the theory does not make predictions about different behavioural responses to positive and negative emotional reactions.

The initial process of emotional reaction to workplace events is described by (Slater, 1998), as; *"intricately tied to one's events, emotions, and personal set of goals and values".* The positive or negative tone of the emotional reaction thus arises from how it may impact one's personal goals and preferred states, in which the individual's state of mind at the time of the event provides a kind of filter that frames the nature of the events with respect to the individual's goals (Mendel, 1999). Significant workplace events such as; layoffs, promotions, and raises, often bear upon either growth or development needs or security needs. Thus, an individual's regulatory focus sets the person up to react to an event in either a more optimistic (promotion focused) or pessimistic (prevention focused) light. When an individual interprets an event through a promotion focus, the resulting behaviour is generally, an approach, behaviour, while a prevention focus tends to engender avoidance behaviour, while (Pumphrey, 2003), further suggest that employees' resistance to change might take two fundamentally different forms depending upon its focus. Promotion-focused resistance to change might occur when employees feel that the nature of the change blocks their achievement of desired job or career goals. Prevention-focused resistance to change might result when employees worry, that the nature of the change might prevent them from living up to their responsibilities.

7.12. Author's Analysis of Psychological Factors

In the author's opinion, the introduction of ERP and BI solutions into the modern working environment has been greeted in broadly one or two ways. There are those who have a high level of trust in the technology and, clearly see the benefits that the technology has to offer and are happy to embrace it. These are the optimists, those who embrace the technology, and view it as increasing both productivity and employee quality of work life. They see ERP and BI as both having the ability to free employees to work on more challenging tasks by taking over the routine aspects of jobs, thus increasing productivity and competition and creating more employment in the long run. There is however, a second group, who have a low level of trust in the technology and tend to see, only the negative aspects of these systems, and the consequent impact that the technology may have on their work practices, and even on their careers. These are the pessimists, who associate automation with loss of employment, deskilling, physical and mental problems, and a tightly controlled work environment. The author further refines this thinking by suggesting that these two groups subdivide into two further categories. There is a group which is active in relation to the technology, and another group who maintain a passive stance when confronted with the technology. This gives rise to four distinct groupings which are as follows:

- ❖ Enthusiastic Followers.
- ❖ Enabling Embracers.
- ❖ Apprehensive Advocates.
- ❖ Determined Rejecters.

The author illustrates this relationship in the BI Psychology Adoption model Figure 67.

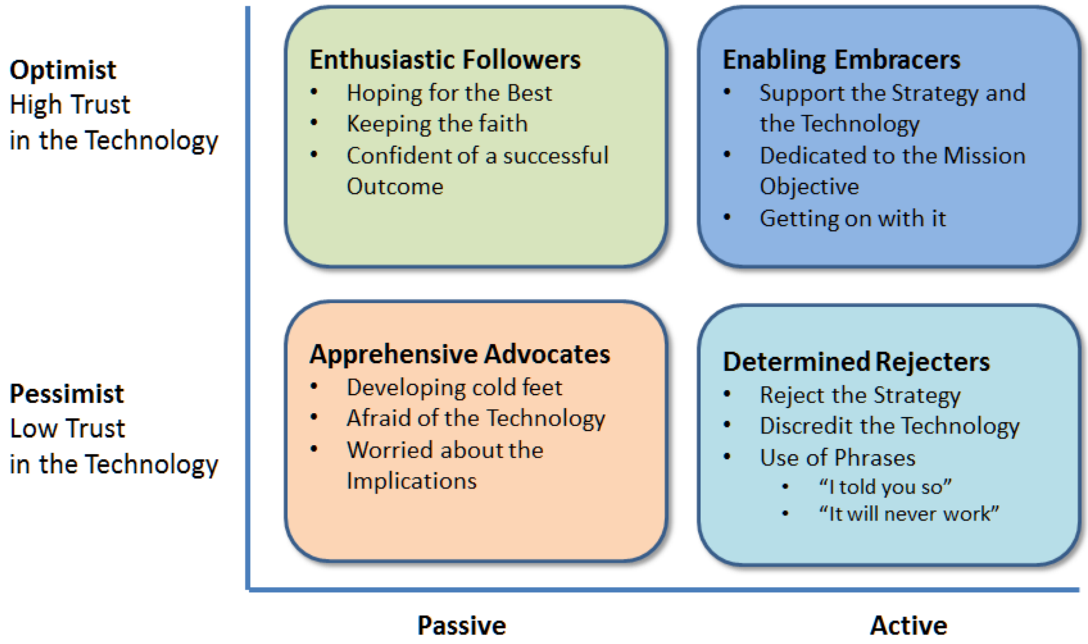


Figure 67: A BI Psychology Adoption Model. *Source: Sturdy 2012*

One reason why employees and even management are ambivalent about the effects of technology in general, is that it can sometimes be difficult to be clear about the consequences of a particular strategic direction with regard to its implementation within the workplace. Optimism, is a generalised belief that good things will happen in the future (Wallace, 1971), and is usually related with positive outcomes such as higher achievement, increased perseverance, higher work motivation, coping with serious disease, and concern with health threats (Willer, 1967). This is because optimism is positively related to several proactive strategies such as active coping, planning, and deliberate seeking of social and emotional support (Wallace, 1971). One might therefore, expect optimism to relate positively with individual proactive coping (Gans, 1971). This is where the Enabling Embracers are positioned within the diagram, in the active optimist position. These represent a group who are generally well disposed to the introduction of new technology, and do not see it as representing a challenge, but rather a pathway to new opportunities.

Optimists however, can become passive and accept what might happen when they find themselves in what they consider to be difficult or uncontrollable situation (Hempeî, 1965), such as when they are confronted with a level of technological change that they have difficulty in coping with. Increased anxiety can result, as people engage in repetitive mental simulations of potential dangers without finding solutions to them (Popper, 2002). This group, the Enthusiastic Followers, is represented in the top left-hand quadrant of the diagram, the passive optimists.

The third group, represented by the Apprehensive Advocates, are positioned within the passive pessimist quadrant. It is interesting to note that the positive outcomes of optimism do not necessarily indicate that pessimism has detrimental consequences. On the contrary, research has found that pessimism can lead to positive outcomes, such as better academic performance, more supportive friendship networks, and greater progress toward personal goals (Gofiman, 1959). An explanation that has been advanced for this relationship suggests that a pessimistic view of the world leads pessimists to prepare for the adversities of the future, which makes them search in an anticipatory way for the resources and solutions they might later need for solving the problems and the burdens they expect to face (Spencer, 1898).

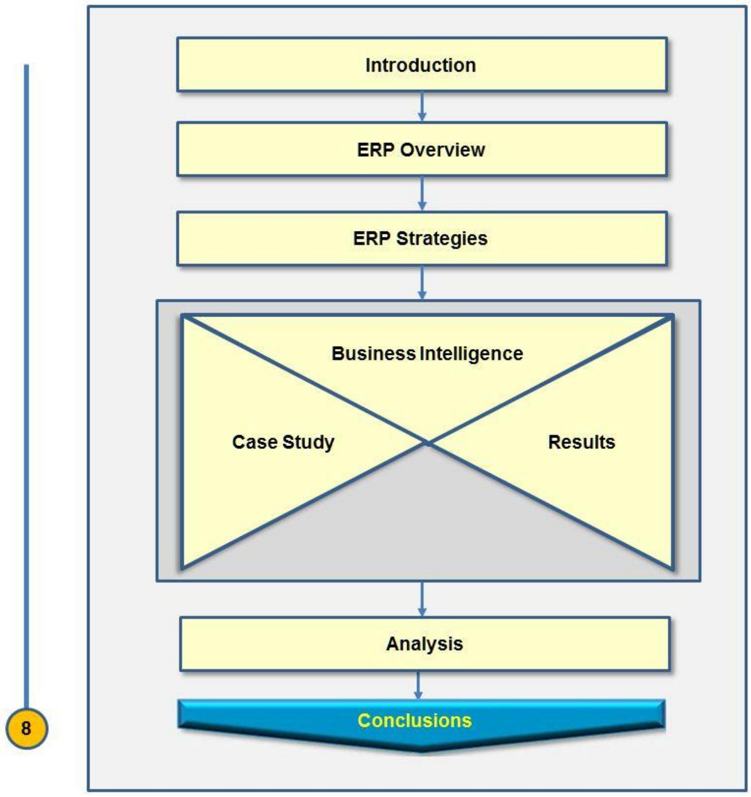
The fourth and final group, the Determined Rejecters, are located in the active pessimist quadrant. It is the author's experience that the people represented by this group, do not reject the technology per se, but that, their thinking is informed by a hidden agenda, which stems from what they perceive to be negative aspects of the technology, which gives rise to a number of fears. The main reason for the resistance towards change are fear of failure, fear of being redundant and fear about the uncertain future. The number one fear of the people within this group is that the introduction of ERP and BI programmes will result in the loss of their jobs. They become nervous about the real possibility that the new technology will equate to job losses. These fears are not without foundation, there have been many reported instances of technology driven IT advancements resulting in significant layoffs from large organisations. A spectacular instance of this is represented by the newspaper industry, when they switched over from manual printing presses to computerised printing methods. Overnight, thousands of highly qualified print setters became redundant, but although these people were highly skilled in their craft, unfortunately it was a craft that the world no longer required. Another very real fear is that of; not understanding the new technology, or of being unable to come to terms with it. Whereas, methods can be employed to integrate people in groups two, and three into to the thinking that is required, this can be much more difficult to achieve with this particular group. Resistance by the people within this group can be problematic, as their behaviours can have a negative impact on the use of the technology within the organisation. The effect of the technology within this group is to create an emotive response, which is not necessarily associated with any particular logic, but results in a determined resistance to the implementation of the technology. As a result this group, do not only look for ways in which they can impede the progress of the technology, but they also engage in activities that are deliberately designed to provoke system failures. They then use these system failures to claim, that the systems should never have been introduced in the first place. This unfortunately for the members of this group can lead to a situation where they may be *"invited"* to seek other career paths over a period of time.

In summary, the BI Psychology Adoption Model proposes four distinct groups with respect to the adoption of ERP and BI systems. The Enabling Embracers do not represent a problem, and in fact, they promote and drive, the technology. The Enthusiastic Followers are also, not really a problem, but a method has to be found to raise their levels of confidence and trust in the technology. The Apprehensive Advocates are a bit more problematic, as they are not really engaging with the technology, and this over a period of time can lead to an ever widening gap developing, which at some future point, may prove very difficult or even impossible to surmount. The final group, the Determined Rejecters are probably the group which represents the biggest problem to surmount. It may be that it is not possible to bring members of this group *"on board"* and therefore, other options would have to be taken into consideration with regards to the career paths of the individuals involved. The correct application of the model should assist in the task of informing management of the extent and scope of emotive reactions to the introduction of technology within the workplace, and also provide guidance as to what the management approach should be, when it has been established what group a particular individual is identified with.

Chapter 8

Conclusions

"A dreamer is one who can only find his way by moonlight, and his punishment is that he sees the dawn before the rest of the world." - Oscar Wilde



The hypothesis on which this doctoral thesis is based is to demonstrate that: *"ERP and BI strategies correctly applied, and in combination with e-marketing and Website development, can produce a synergy greater than the effect of any individual component, which can greatly enhance the overall profitability of an organisation, which has not been previously realised"*.

Within the introduction, the need for organisations to be able to gain and, to maintain a competitive advantage was identified. One could be forgiven, for underestimating the significance of IT with regard to its influence on the strategic thinking of an organisation.

However, the realisation of the use of IT, as a tool to be used to achieve strategic competitive advantage is not a particularly new one. Michael Porter emphasised this point in 1985, when he stated that; *"This technology is transforming the nature of products, processes, companies, industries, and even competition itself. Until recently, most managers treated information technology as a support service and delegated it to EDP departments. Now, however, every company must understand the broad effects and implications of the new technology and how it can create substantial and sustainable competitive advantages.*" (Porter and Millar, 1985). At the commencement of its ERP and BI programmes, PDV realised that, as powerful as the individual components of these different systems were, that acting in isolation from each other, they would not be able to confer the type of step change that was required within the organisation. It was only by combining these systems in such a way, that the strength of each one could be harnessed to allow them to form an integrated part of the overall solution. A critical consideration in developing the overall programme related to the selection of programme packages that could not only work well with in-house legacy systems, but would also provide the capability to be extensible with other programmes, in particular those requiring the use of Web based technologies.

It was this strategic thinking that informed the management decisions, when considering the implementation of the initial ERP system. Although, quite a number of reasons have been provided within the text as to why SAP was selected as the ERP supplier, not least among these are its capabilities to become, and act as a Web enabled platform. SAP provides a capability to build Web services in its development programming language, ABAP, and offers Web services execution on its SAP Web Application Server. This service is made possible through the use of standalone Web applications with presentation logic, workflow logic, and application logic that are functionally self-contained. Due to its many advantages, Server Page Technologies have become relatively widespread in the field of Web development. BSP applications are developed on the SAP Web Application Server using the Web Application Builder. Like standard applications, BSP applications can access function modules, classes, BAPIs, and the database, which are linked to the Change and Transport System (CTS) (Heinemann and Rau, 2003). It is this type of technology which will assist in the transition from the current third wave of the technologies into the fourth wave and beyond. A key prerequisite of any ERP or BI programme, that an organisation is considering embarking upon, is to have as much information as possible with regard to both its internal and external environments. The knowledge of where the organisation is placed with regard to the opportunities and challenges that it is currently faced with is an essential component that is required in informing management with regard to the options that are available to them. Based on an informed analysis of its position, management can decide on such matters as the scope of the programmes that it is considering implementing; and whether the organisation has at its disposal the necessary resources required to see the programme through to completion. One of the tools that PDV decided to use in this regard was the SPACE Matrix. Although there are a multiplicity of such tools available for this type of analysis, PDV considered this one to be most appropriate, as it incorporated a number of factors not included in other analysis tools. The analysis that was performed using this methodology indicated that PDV was in a somewhat conservative position, and as such, the growth potential of the business was somewhat constricted. It confirmed the necessity for PDV to adopt a more aggressive stance within the marketplace, not only to maintain its existing market share, but also to increase its penetration within the marketplace. The subsequent financial analysis which was performed, demonstrated to PDV that it had the financial resources available to undertake the ERP and BI programmes that it envisaged for the organisation.

Within chapter two, the author discussed many of the definitions which had previously been put forward with regard to ERP. Although, many of these definitions provide a number of ways in which to define ERP, the author is of the opinion that these definitions define ERP in terms of an operational system, and do not take into account the broader context in which it is required to operate, especially in today's Web-enabled environment. The author therefore, put forward a definition which encompasses these aspects of the technology, which is:

"ERP systems are software packages that integrate information in order to support the strategic alignment and vision of the organisation within a quality framework."

This definition places ERP in the context of an enabler to support the strategic vision of the organisation, and to do this in the context of a quality framework, which is an aspect of implementation which has been somewhat overlooked in the literature. It also ensures that management understand the role that ERP should supply as an enabling technology, and not one that should drive the strategic vision of the organisation. In other words, management must avoid falling into the trap of implementing ERP for the sake of it. The primary reason for the implementation of such systems must always be, to secure competitive advantage. As more and more organisations move towards ERP systems, the question arises as to the extent of the advantage that ERP confers, if everyone is using the technology. The arguments around this question were discussed in chapter two, including the perspective offered by Carr. Although a number of the viewpoints expressed have merit, there is little doubt, that many organisations would now find themselves at a serious disadvantage, if they did not embrace this type of technology. An issue that has come to the fore within many organisations within recent years is that concerning the use of social media within the workplace. Many organisations frown upon the use of such applications within the workplace, considering them to be distractions which waste valuable time and resources. There are other organisations however, who are trying to identify ways in which they can make profitable use of these applications such; as Wikipedia, YouTube, Facebook, Second Life, and Twitter. PDV certainly belonged to this second group and through the use of Social Media as explained in chapter six it was able to leverage this technology to generate enhanced income streams.

8.1. ERP and BI

Chapters two, three and four identified the major components and systems in both the ERP and BI platforms. The main requirement of an EP system is to combine corporate-wide data from various sources so that corporate employees, external partners, suppliers, and distributors can make good use of the data. However, there is also the additional requirement within many organisations to distribute data across organisational boundaries, and to various operational levels, targeted at specific business needs using dynamic reporting and real-time analytics. ERP systems on their own do not provide all of the required functionality to be able to perform these tasks. Whereas, ERP systems provide a powerful capability for processing and storing transactional data from various internal and external sources, it is not the most effective data distribution system in existence. It is through the application of specific BI tools, that have the capability to generate various aspects of business views through manipulating existing data captured by a company’s IS, that enables the organisation to provide the range of distribution and communication channels that are required. BI systems, used in this way provide the functionality to empower employees’ decisions capability in a faster and more reliable way, and it provides better business information through a comprehensive analysis of organisational data. Within the thesis it has been demonstrated how both systems could be integrated, in order to assemble all the required data from the ERP system and then load them into a DW, and then link to BI tools, such as OLAP, Data

Mining, and SQL in order to create a more consistent and knowledge-centric data reports. In this way it was demonstrated how both BI and ERP integrated framework adds value to the enterprise system. BI systems are now gaining much more acceptance as organisations have begun to realise the benefits of its decision support capabilities. Companies that were in the past, unable to justify ROI for ERP implementation are now implementing BI software since it has been clearly demonstrated that BI enhances the utilisation of the enterprise data. ERP systems provide the capability to streamline enterprise transactional data. In this way BI systems add intelligence to the ERP data. Together, ERP and BI provide the ability to greatly improve the IT performance and decision-making capability inside the organisation.

8.2. The Case Study

The case study in chapter five, and the subsequent results obtained, demonstrated in a very clear way, how both the ERP and BI systems were integrated in such a way as to provide real tangible benefits to PDV. However, this was not achieved without a cost, and the major challenges that were encountered along the way have also been clearly identified. No two organisations are the same. All organisations have cultures that make them unique. Having said that, many of the characteristics of modern organisations are becoming more unified as technology permeates the organisational structure, and the use of common platforms for communication and SCM integration is not only a requirement, but a necessity. This is what drives the imperative for BI solutions. The factors that PDV considered when implementing its BI systems solution, stemmed from a systematic thinking which reflected a determined effort to consider all elements of the systems impact upon the organisation. In this way, many of the negative aspects of systems integration were avoided, while the benefits to be gained from the systems were leveraged to provide the maximum possible benefit to the organisation. The results achieved across the organisation in terms of reduced costs, considerably reduced inventories, and increased ROI were easily identifiable. However, these were not the only benefits that resulted from the implementation of these systems. Other intangibles, which can’t be directly measured, but none the less, have a great bearing on the operation of the company also improved significantly. The communications network was greatly improved, which resulted in a much improved flow of information and ideas between the management and the employees. Supply chain performance was greatly improved through a much more efficient supply chain network. The relationship between PDV and its customers was greatly enhanced through the use of a much improved CRM model. Therefore, when one considers the totality of the benefits of the overall system, the need for such applications is clearly identified.

8.3. SCM Integration

The impact of ERP upon the supply chain has been demonstrated within chapter six. From a technological perspective, ERP can be considered to be the backbone of SCM, as they both rely on very similar structures and frameworks, such as intranet, extranet and EDI, it is very possible and feasible for their integration. Most ERP system providers have been enhancing their products to include sales-force automation, data warehousing, document management, and after-sales service and support, the most important trend today being the integration of ERP with SCM. The future of ERP is to improve the supply chain and foster greater collaboration across multiple enterprises. The core aspects of an ERP system represent an integrated set of applications that link together a range of back-office operations such as manufacturing, financials and distribution, which represents a subclass of a much bigger and broader enterprise system. Into the future, ERP will further extend into transportation, warehousing, sales-force automation, and even beyond that into engineering with computer-aided design and product data management systems (McGee, 1998). Consequently, it is feasible and possible for the integration of these two technologies (Tarn *et al*., 2002). Knowledge and information in relation to the business environment are the most important issues in the competitive sphere within the global competitive environment, therefore, the IS of companies have to cooperate and coordinate their relations with each other. It is not be possible to provide such an environment without an integrated system covering all sections of the company, from financial and administrative departments through to production line and storage. Based on this, ERP can be defined as an integrated part of the planning software, that integrates the main business processes in a company (Pressman, 2001). Within the SCM context (Eshlaghi *et al*., 2011), state that, the most important advantages of using ERP lies in the integration of the supply chain, which provides the following benefits:

- The ERP systems provides a sharper vision for the management supply chain which results in making those decisions that are more profitable in the Management Supply Chain.
- Any changes that occur within the information in the system are updated automatically without unnecessary delays. Thus the changes can be transferred to other parts of the supply chain almost instantaneously.

- ❖ The ERP systems function more efficiently than the old IS in using the empowering technologies like the Internet, extranet and so on in sharing the information.

Within PDV, the older legacy systems were giving rise to a situation where the supply chain contained a number of extraneous steps which were not contributing in a meaningful way to the overall supply chain efficiency. This in turn was leading to unnecessary delays from a customer perspective as well as the build-up of surplus inventories across several nodes within the chain. The efficiencies brought about through the implementation of the ERP system altered this situation dramatically. The principle way through which this was achieved was by the fusion of forces within the organisation to provide a much improved supply chain process which resulted in much greater manufacturing efficiency and distribution effectiveness. This came about as a result of PDV being able to integrate each of the company's internal systems to those of its suppliers, partners, and customers. SCM acts as a cross-functional system that uses information technology to help support and manage the links between some of a company's key business processes and those of its suppliers, customers, and business partners. The goal of SCM is to create a fast, efficient and low-cost network of business relationships, or supply chain, to get a company's products from concept to market.

8.4. Implications

This doctoral thesis has demonstrated how both ERP and BI can be integrated into the strategic business model. However, it has also demonstrated that the integration of these systems into the business model should not be an end within itself, but rather to serve the ultimate aim of improving the customer relationship, and that the correct application of CRM techniques results in increased productivity and ROI. The emergence of e-commerce has changed many aspects of existing businesses and has resulted in many new companies which embody new business models, business opportunities, and processes. Existing companies are being challenged to rethink the most basic business relationship, which is the one between the organisation and its customers. Although, much has been written about the role of the Internet and the way in which it has changed the way in which organisation engage with customers, it hasn't changed the underlying business fact that addressing the needs of the customer leads to sustainable profit. The creation of new contact channels through the use of Internet technologies has not replaced the need for human contact at key points in sales, marketing, and customer support. Figure 68 contrasts traditional CRM with e-CRM.

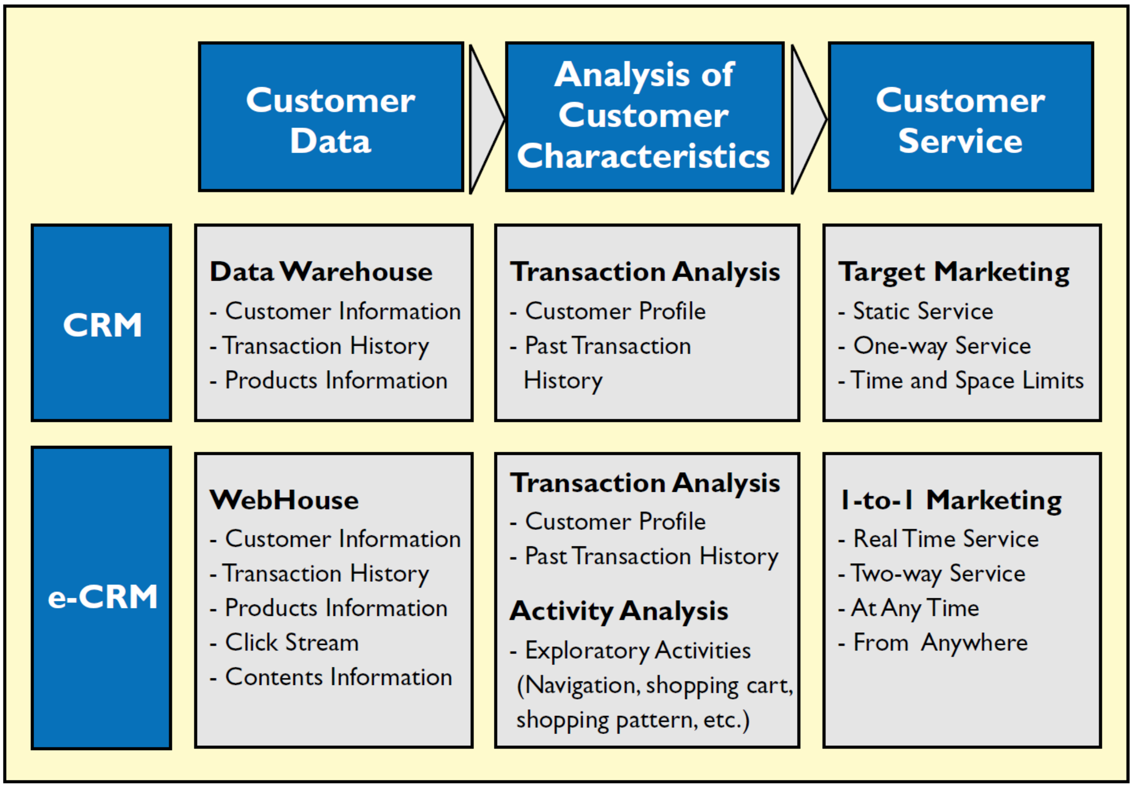


Figure 68: The difference between CRM and e-CRM. *Source: (Pan and Lee, 2003)*

E-CRM expands the traditional CRM techniques by integrating technologies of new electronic channels, such as Web, wireless, and voice technologies, and combines them with e-business applications into the overall enterprise CRM strategy. In other words, what the traditional CRM delivers can be considered only a fraction of an e-CRM solution (Pan and Lee, 2003).

Within PDV, the utilisation of the technology also resulted in the reduction and elimination of many of the paper-based, low-productivity systems within the organisation. This has resulted in the attaining and maintaining of a mutually beneficial relationship as a result of PDV being able to provide a more intimate and harmonious relationship between the organisation and its customers. Much of this benefit has come about through the creation of a number of different channels which PDV have been able to develop and exploit in order to be able to become much more cost effective and revenue-efficient, while at the same time providing the levels of service that the consumer requires. (Pumphrey, 2003), makes the point; that rather than working harder and faster with a fundamentally flawed architecture, leading practice firms are migrating to a core set of services combining application and infrastructure templates. The outcome is; lower cost and time to market, higher flexibility, higher robustness, and lower total cost of ownership. In order to satisfy on going and ever changing customer needs, companies have to maintain consistency across all interaction channels, and across all areas of a company a customer interacts with. Prior to the introduction of CRM technologies, the number of channels by which consumers could communicate with PDV was somewhat limited, mainly comprising of traditional mail, or face to face communications.

CRM has allowed for the creation of many new channels, which include the use of; email, SMS messaging, interactive Web portals, which offer both the provision of feedback through blogs, and the facility to communicate directly with a member of PDV staff though a Web chat facility. The ability to be able to deliver personalised content to customers not only to their computers, but also to their mobile devices is another important use of this technology. When the number of channels available for communication increases in this manner, than an important component of the strategic thinking of the organisation must be the consideration of how the different channels will be utilised, and how they will be combined or mixed when communicating with the customer in a manner that integrates with the overall strategic thinking of the organisation. An illustration of how the channel strategy fits in with other aspects of the overall business strategy is illustrated in Figure 69.

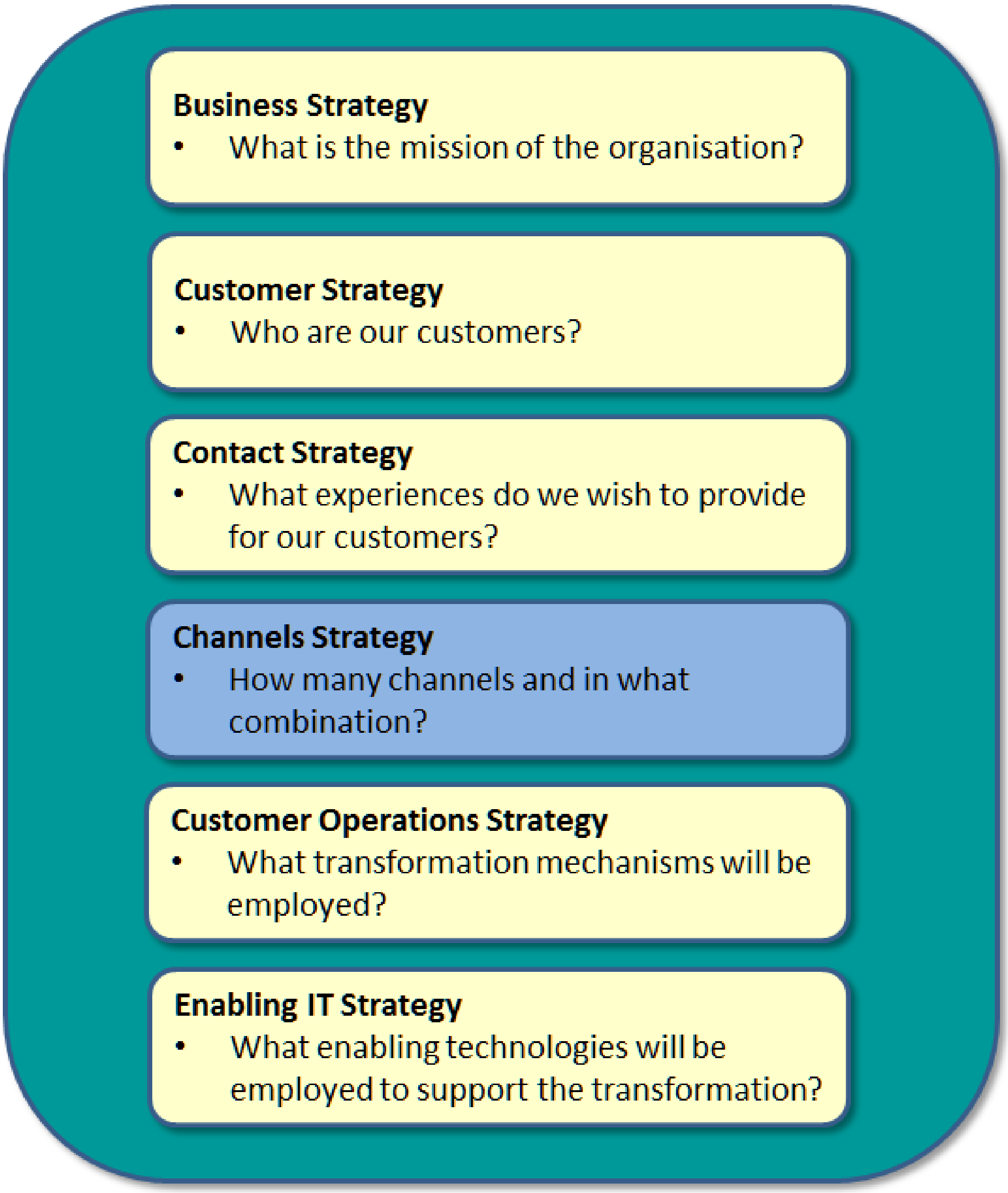


Figure 69: Position of the Channel Strategy within the overall Strategic Framework

Within the channel strategy, consideration needs to be given to the reasons that customers need to contact the organisation, and what channels they will use in doing so, in other words, what will drive the conversation from the customers perspective. The collective reasons for these conversations are normally referred to as the *"contact driver"*. To illustrate this point, customers who wish to make a direct complaint about a particular product are directed towards a phone number which they can call, which puts them into direct contact with a member of the support staff. This has the benefit of soothing the customers concerns, as they now have someone who they can explain their problems to, and it also allows them to vent any possible frustrations they are experiencing. When the contact person demonstrates empathy towards the customer's predicament, this automatically has the effect of lowering the emotional temperature of the discussion. However, in a situation where a customer just wishes to comment on an aspect of service, or product quality, then they are encouraged to do this through the dedicated section of the company Website. An important aspect of the channel structure is that it can work seamlessly to support the customer requirements, enabling them to choose the channel of their choice, when performing such tasks as; placing an order on the Web, altering it over the phone, and re-ordering via email. Previous thinking with regard to the role of e-commerce within organisations was that competitive prices and the availability of personalised offering were the main factors that drove customer demand, instead, what the experience of PDV demonstrated, was that accessibility and convenience were seen to be the most important benefits by a majority of its customers, which demonstrates that these are the primary motivators for embracing online shopping.

8.5. Limitations

Although, much has been expected of ERP and BI systems, they have not always met these expectations, and the consensus now is that the industry has not been performing as it was originally expected and intended. According to an ERP survey, when quantifiable cost savings and revenue gains were balanced against the amount that had been paid out for software, hardware, consulting help and on-going support, there is an average negative value of €1.5 million (Stedman, 1999). Cost is another aspect that has to be given serious consideration to, when implementing ERP and BI systems. While the range of ERP implementation becomes broader with the introduction of fast upgrading software applications, enterprises adopting ERP systems find that the cost of such systems continues to escalate. Companies that install ERP systems may underestimate the total cost of ownership. EPR systems have an average total cost of ownership of €10 million, but the net present value, after full implementation has a high probability of being a negative figure. In addition, implementation of these systems can often take much longer than originally anticipated. Hidden costs associated with the ownership of these systems have been identified by (Slater, 1998, Soh *et al.*, 2000) as the following:

- ❖ Training is the most underrated hidden cost. The cost to train an entire staff on a new system and process is enormous. This cost often gets taken for granted.

- ❖ Integration and implementation are often overlooked. Many consultants recommend multiple dry runs with real orders. Too often add-on modules such as taxes and bar coding are not factored into the test runs.
- ❖ The cost for data conversion is hidden. Companies often do not recognise the cost associated with transferring data from the old system to the new package. Included in this cost is the need to modify the data to fit into the new system. The need to hire professionals can send this type of cost higher.
- ❖ High consulting cost becomes inevitable. Though this cost is not entirely hidden, many companies do not budget consulting fees properly. Experts recommend contracts be set up prior to implementation, which outline goals to be met by target dates. In addition to the significant knowledge disparity among implementation personnel and the insufficient understanding of the functionality of ERP systems and the implications of adoption among users, high cost is invited as critical areas of mismatches could not be successfully identified by the consultants who lack understanding their customers' business processes.
- ❖ A cost often overlooked is the notion that the project will end on a certain date. Management must recognise that these projects require unique budgets.

In many cases with ERP and BI systems, it is necessary for the organisation to change the way that it does business in order to benefit from a migration to enterprise solutions. Because the systems are complex, organisations typically do not have the required expertise in-house to implement the systems and implementation can take a long time to complete (Davenport, 1998a, Mendel, 1999). It can be the case that, they find themselves relying on consultants or employees of the software vendor, and such assistance can come with a very high price tag. As more and more, organisational data moves into the electronic domain, there is an increasing risk associated with the security of the data, and this is becoming an issue of increased importance as organisations migrate, their data sets to the Cloud. This risk of the data being compromised makes some potential customers nervous. There is little doubt that as organisations migrate increasing amounts of data to the Cloud, the number of potential security risks increases. The security features of the hosting service need to be very well understood, as there are potentially quite high risks involved in having transactional data on an untrusted host. Transactional databases typically contain the complete set of operational data needed to power mission-critical business processes. This data includes detail at the lowest granularity, and often includes sensitive information such as customer data or credit card numbers. Any increase in potential security breaches or privacy violations is typically unacceptable (Abadi, 2009). Within the United States, the Patriot Act allows the government to demand access to the data stored on any computer; if the data is being hosted by a third party, the data is to be handed over without the knowledge or permission of the company or person using the hosting service. Although one tends to think of the Internet as a service that is continuously available, the reality is that like all other systems, it is prone to failure. There are two important consequences to this. First; there is the inconvenience factor of not being able to access ones data, but a far more serious problem is the possible loss of the data. The way that many organisations deal with this issue, is to have critical data stored in different physical locations, in what are referred to as *"Data Mirrors"*. However, the setting up of these mirrors can be costly and it increases the complexity of the security issue. Most organisations are willing to take on these additional complications, as they realise that these costs are somewhat trivial, compared to the loss of the actual data. Another limitation of BI systems, is the difference between the model of the business environment that the system attempts to formulate, and that of the real world.

No matter how well designed a BI system is, its ability to capture the complexity of real-world phenomena will always be constrained by its data set and operational parameters. According to (Kochan, 2000), the principal problem ERP system solutions face is their inability to process data real time. The packages are often overburdened with information and are forced to process information in cycles, rather than in real time. This forces ERP systems to be reactive instead of proactive. It is this reactive processing that makes it difficult for demand and factory planning. These functions rely heavily on the constant evaluation of information regarding processing, materials, and constraints within the process. Without real-time processing, the data for these functions becomes obsolete and relatively useless for planning. As the real-world business involves many elements and relationships, interacting dynamically, there can only be one reality at any given moment in time, but there are many different ways in which this reality can be interpreted using BI systems. However, both the organisation and individuals within it, interact with the real world on the basis of their internalised descriptions of it. Ideally the BI system should contain a comprehensive description of the business environment in the DW that allows users to understand it in terms that are meaningful to them. Not every facet of the business model can be contained within the BI system, therefore, by necessity, in order to maintain the system within manageable proportions, the more essential data will be contained within the system, while other data considered to be not so important, will be omitted. Thus, the DW at the heart of the BI suite represents a *"compressed"* version of the external business reality. It has become one way of describing the real world to its end users. To the extent that the BI suite is able to yield accurate analysis and prediction of the environment, we can say that the designer's compression of the external reality has captured its significant features. Therefore, the DW is a kind of *"shorthand"* model of the real business world that it attempts to analyse.

8.6. Future Directions

As ERP and BI technologies continue to evolve, there is now a growing trend to computer processing, storage, and software delivery away from the desktop and local servers, across the network, and into next generation data centres hosted by large infrastructure companies. (Abadi, 2009), makes the point, that; Just as the electric grid revolutionised access to electricity one hundred years ago, freeing corporations from having to generate their own power, and enabling them to focus on their business differentiators. Cloud computing is hailed as revolutionising IT, freeing corporations from large IT capital investments, and enabling them to plug into extremely powerful computing resources over the network. This trend is set to continue into the future as organisations wish to reduce the total cost of ownership associated with ERP and BI systems. Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centres that provide those services. Quite where the term *"Cloud computing"* originated from is not so clear. It has been suggested by (Bogatin, 2010), and by a number of others that Cloud computing terminology was, perhaps, first coined by Google Chief Executive Eric Schmidt in 2006. However, (Kaufman, 2009), suggests that Cloud computing terminology *"originates from the telecommunications world of the 1990s, when providers began using Virtual Private Network (VPN) services for data communication"*. Cloud computing has its roots in the development of Software as a Service (SaaS), which was first delivered in the late 1990s, although these offerings weren't referred to as Cloud computing at that time. Early successful adopters of the SaaS model include firms such as Salesforce.com and NetSuite (netsuite.com). Salesforce.com offers on-demand customer relationship management software solutions built on its infrastructure and delivered directly to users over the Internet. It has annual revenues of over $309 million. Salesforce.com does not sell perpetual licenses; instead, it charges a monthly subscription fee starting at

$65/user/month. Similarly, NetSuite offers subscription-based access to its ERP software, which is targeted toward small and medium-sized businesses. Smaller businesses are less willing to invest in large, expensive systems that they have to maintain and are thus attracted to the SaaS model (Choudhary, 2007). A definition of Cloud computing provided by (Buyya *et al.*, 2009), defines it as follows:

"A Cloud is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers."

Cloud computing provides a scalable online environment which facilitates the ability to handle an increased volume of work without impacting on the performance of the system. Cloud computing also offers significant computing capability and economy of scale that might not otherwise be affordable to businesses, especially small and medium enterprises (SME's) that may not have the financial and human resources to invest in IT infrastructure (Choo, 2010). There have been numerous predictions by industry analysts as to how Cloud computing will transform the entire computing industry. According to research conducted by Merrill Lynch, *"Cloud computing is expected to be a $160-billion addressable market opportunity, including $95-billion in business and productivity applications, and another $65-billion in online advertising"* (Hamilton, 2008). In another research study conducted by Morgan Stanley, they have also identified Cloud computing as one of the prominent technology trends. As the computing industry shifts toward providing Platform as a Service (PaaS) and SaaS for consumers and enterprises to access on demand regardless of time and location, there will be an increase in the number of Cloud platforms available. Recently, several academic and industrial organisations have started investigating and developing technologies and infrastructure for Cloud computing. As the technology progresses, organisations won't take on the cost of owning, installing, and maintaining database software, but will instead access virtual machines, accessed through the Cloud, through which they can install and run their own software. Within this scenario, resource availability will be a function of the organisational requirement, with access to increasing amounts of computer power and storage available on demand, in a pay-only-for-what-you-use pricing model. The trend now, and into the future is moving towards mobile devices which can provide information in a range of different environments, and not just at the workplace. New devices such as the iPhone, iPad, Blackberry (though in decline now), and Google Android devices, are making mobile business applications a much more realistic prospect by providing larger screen sizes and the fact that they are portable, light and allows users to quickly access information all with the touch of a fingertip. Today, more executives and managers are using mobile business applications to collect data or even add information to a plan or forecast while on the move. Enterprises and organisations will also move to make further use of grid computing which is a form of distributed computing in which the use of disparate resources such as compute nodes, storage, applications and data, often spread across different physical locations and administrative domains, is optimised through virtualisation and collective management (Srinivasan and Treadwell, 2005). Figure 70 illustrates a simple grid in which services are used both to virtualise resources and to provide other grid functions.

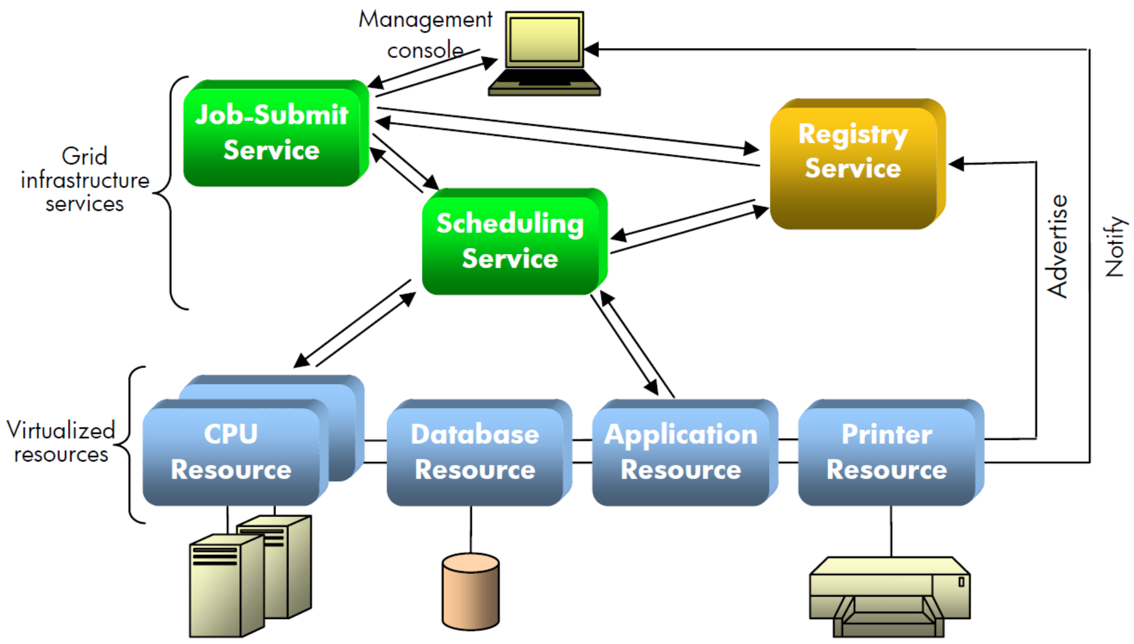


Figure 70: In Service-Oriented Grids. *Source: (Srinivasan and Treadwell, 2005)*

Additional emerging technologies which will rise in prominence include the following:

In-Memory Analytics: In traditional databases and warehouses, queries are run against data that is stored on relatively slow hard drives. In-memory analytics is able to provide a significantly more efficient approach, because all the relevant data is loaded into memory. This results in dramatic improvements in query response and the end-user experience. This has become possible due to the adoption of 64-bit architectures that enable larger addressable memory space, and also due to the rapid decline in memory prices. This now makes it possible to analyse large data sets entirely in-memory. This results in a dramatic increase in performance due to the fact that accessing data directly from memory is many orders of magnitude faster, than accessing the same data from a hard drive. This also provides the added benefit of being a much simpler approach to traditional data warehousing and could even lead to the DW being eliminated from the process entirely. IBM has recently introduced an integrated reporting, analysis and planning solution, which they refer to as Cognos Express. They claim, that this makes it is possible to create plans, budgets and forecasts which can be built on top of an in-memory analytics server.

Mash-ups: Originally the term mash-up was used to describe the mixing or blending together of musical tracks. The term is now used to refer to Websites that weave data from different sources into new Web services, as noted by (Hof, 2005). Mash-ups represent a very interesting phenomenon, as the underlying technologies involved are not really that innovative; software developers have been sharing, reusing, and combining applications and code for decades, using code libraries, components and APIs to speed up development, (Heineman and Councill, 2001). The interesting thing about mash-ups, is they are being widely used for the rapid realisation of creative ideas which would be too time consuming, or expensive otherwise. Mash-up developers are able to use Application Programming Interfaces (APIs) to access data, services, resources, and interface components, which they incorporate into their new application. Mash-ups facilitate innovation by providing access to highly developed, robust technologies which only a large organisation of expert programmers can create. They provide access to large amounts of content which no individual could gather on their own or afford to keep and maintain, and they lower the barriers to developing creative novel applications with powerful technologies.

Integrated Search: This represents a technology that allows a user to search from multiple locations simultaneously, such as local hard drives, Websites, e-mail, and other sources without having to open a browser, e-mail client, or other application. These applications use a uniform interface that resembles the interfaces provided by the traditional search engines. The main difference is that they contain individual pull-down menus for specifying a range of the options which are supported by the search engines. This provides for the possibility to specify detailed queries with very little effort. This facilitates the construction of complex search queries and the execution of multiple search requests in parallel to improve query response time.

8.7. Mobile Applications

Not many years ago, most mobile devices had somewhat limited capabilities. The initial smartphones were either entirely email focused or lacked sophisticated touch screens that could be used without a stylus. Even fewer shipped with a decent mobile browser capable of displaying anything more than simple text, links, and an image. This meant that if you were in possession of one of these devices, you were either a business person strongly reliant on email or an early adopter, hoping that this would be the year of the smartphone. Then Apple came along with the release of the iPhone, and our expectations for mobile experiences were completely reset (Charland and Leroux, 2011). The original plan for third-party iPhone apps was to use open Web technology. Apple even released tooling for this in its Dash-code project (Lee, 2009). However, within a relatively short period of time, the landscape has been transformed, and now, native apps are the evolving trend, and this is usually for performance reasons. This is leading to a position whereby the mobile Web is being unfavourably compared. Early adopters have been talking about mobile taking over since 1999, anticipating the trend by a decade or so. Today, mobile Web traffic is dramatically on the rise, and creating a slick mobile experience is at the top of everyone's mind (Nicolaou, 2013). Total mobile data traffic is expected to exceed 10 exabytes per month by 2017, as illustrated in Figure 71.

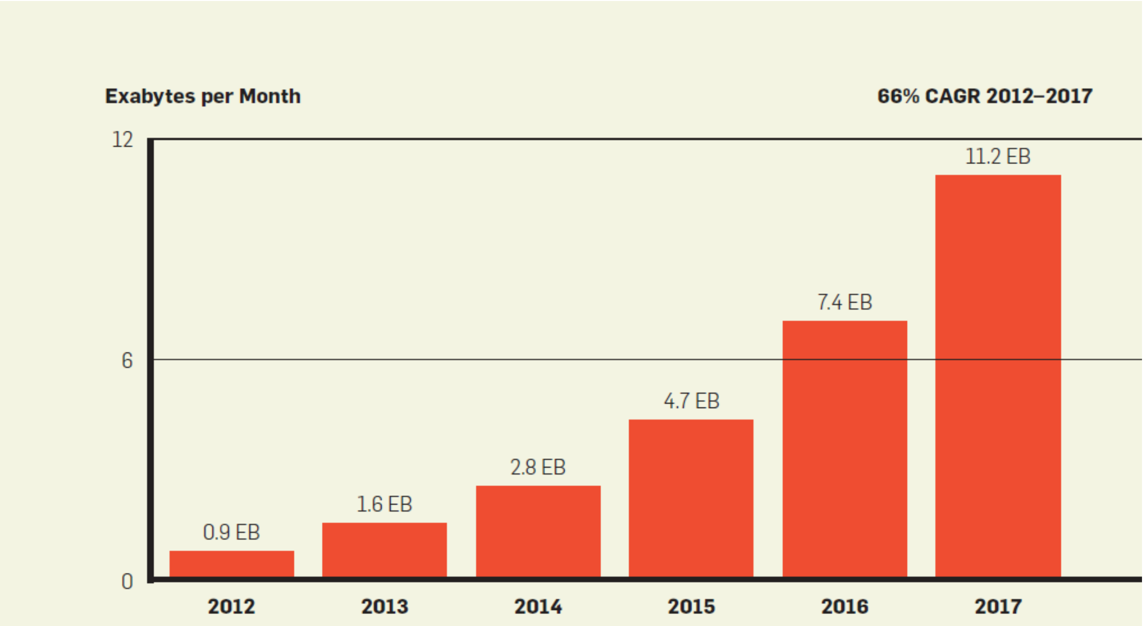


Figure 71: Mobile Data Traffic Projection. *Source: (Nicolaou, 2013)*

Mobile applications are meant for mobile devices, tablet, PC, and other portable media players, and are a “lighter version of computer applications”. The market for Mobile applications has been accelerating towards growth and is expected to achieve a growth rate which will result in a user base of 1 billion by 2013, from 100 million, recorded in 2009 (Howard Rasheed and Rasheed, 2012). In markets like Japan, China, France, Malaysia, Singapore, US and India the demand of smart phones, iPhones, Blackberry phones and Android enabled phones is rapidly rising (Poitou, 2011). The Android Market has extended into over 190 countries. Since mobile phones today are used as a computer, music player, a navigation unit, a notepad, a search device and lot more, various consumer based, as well as business based mobile applications are being developed in the industry. Technology giants of the world including Google and Yahoo have been quick in responding to this environment and have introduced various mobile, applications that let the users search for relevant information through newer modalities (Rishi, 2012).

Much of this phenomenal rise in the use of mobile devices is due in no small part to the advent of *“Apps”*, which are little, self-contained programs, used to enhance existing functionality, in a simple, more user-friendly manner. Smartphones come with powerful web browsers, which means you can do pretty much anything you can do on a desktop computer in a phone’s browser. However, attempting to navigate a URL bar and managing bookmarks on a mobile phone can be a pretty awkward and cumbersome experience. This is the reason that many online sites and services now use standalone apps, giving them better control of the user experience and, hopefully, making everything simpler and quicker to open and use. Take online banking for instance. You could attempt to sign in to your bank’s web site using the phone’s browser, but it will be difficult to enter text, resize the display so you can see the box for the PIN, and having to sign in every time that you want to access the details are all minor modern frustrations. A banking app simplifies the process, remembering your login information for next time, and presenting the critical data about your account in big, chunky fonts, designed to make everything vastly more readable on a smaller phone display. That is the essential idea behind most apps. Their task is to make life easier and better suited to mobile use (Cutlack, 2013).

In an article published in 2010 by Chris Anderson titled: The Web is dead, Long live the Internet (Anderson and Wolff, 2010), he describes the following scenario. You wake up and check your email on your bedside iPad, that's one app. During breakfast you browse Facebook, Twitter, and The New York Times, three more apps. On the way to the office, you listen to a podcast on your smartphone, another app. At work, you scroll through RSS feeds in a reader and have Skype and IM conversations. More apps, at the end of the day, you come home, make dinner while listening to Pandora, play some games on Xbox Live, and watch a movie on Netflix's streaming service. The critical point that Anderson makes here is that, you've spent the day on the Internet, but not on the Web, and that is a key distinction. What this represents is a shift in the digital world from the wide-open Web to semi-closed platforms that use the Internet for transport but not the browser for display. This demonstrates the succinct point, that the Web is, after all, just one of many applications that exist on the Internet. It is predicted that within five years that, the number of users accessing the Net from mobile devices will surpass the number who access it from PCs. For the sake of the optimised experience on mobile devices, users forgo the general-purpose browser. They use the Net, but not the Web. Fast beats flexible (Anderson and Wolff, 2010). Facebook makes extremely good use of apps. The company invited developers to create games and applications specifically for use on Facebook, turning the site into a full-fledged platform ideal for use with mobile devices. This in part may account for its amazing popularity.

Where, at one time, organisations used to shun Facebook, many are now embracing it, as it represents a media channel that can reach over 1 billion people, target the demographic you wish, and provide a direct communication with your customers? It was not long ago (and it still remains the case to a certain extent today), when advertisers could only target mass audiences through the medium of television, radio, and newspapers, as there was no way to target the message to a specific audience. It was John Wanamaker (a United States merchant, religious leader, civic and political figure, considered by some to be the father of modern advertising, and a pioneer in marketing), who stated that; *"Half the money I spend on advertising is wasted; the trouble is I don't know which half."* With the advent of specific platforms like Facebook, which holds a tremendous amount of data about the individuals who use it, plus a great deal of information about their likes and dislikes, this situation has changed radically. Now advertisers can target the specific individual based on the data contained about that individual in their data warehouses. This to a certain extent is an advertisers dream, as this makes it much easier to target individuals who express a desire or a preference for certain items. Many marketing researchers believe that social media analytics presents a unique opportunity for businesses to treat the market as a *"conversation"* between businesses and customers instead of the traditional business-to-customer, one-way *"marketing"* (Lusch et al., 2010). Recently the Target Corporation (originally the Dayton Dry Goods Company and later the Dayton Hudson Corporation, an American retailing company) sent out advertising literature and publicity relating to pregnant women, to a young school going teenager. Her father, when he discovered this was quite angry, and he complained in very forceful terms to Target. However, his daughter was indeed pregnant. Target had worked it out before her father did, by analysing her shopping records and noting that she was reviewing and buying certain products that women only buy when they are pregnant. From this they developed a pregnancy prediction score for women buying similar items, and they even went as far as to predict their due date! There is little doubt that organisations will wish to continue to harness the powerful combination of dedicated platforms and apps which together can provide a synergy for tapping into potential customers and markets that few other technologies can rival.

8.8. Big Data

Data have become a torrent flowing into every area of the global economy (Cukier, 2010). Companies are now generating very large amounts of transactional data, capturing trillions of bytes of information about their customers, suppliers, and operations. Millions of networked sensors are being embedded in the physical world in devices such as mobile phones, smart energy meters, automobiles, and industrial machines that sense, create, and communicate data in the age of the Internet of Things (Chui et al., 2010). As organisations go about their business and interact with individuals, they are generating a tremendous amount of digital *"exhaust data,"* i.e., data that are created as a by-product of other activities. Social media sites, smartphones, and other consumer devices including PCs and laptops have allowed billions of individuals around the world to contribute to the amount of big data available. The growing volume of multimedia content has played a major role in the exponential growth in the amount of big data. Each second of high-definition video, for example, generates more than 2,000 times as many bytes as required to store a single page of text. In a digitized world, consumers going about their day, communicating, browsing, buying, sharing, searching, create their own enormous trails of data (Manyika et al., 2011). Several research teams have studied the total amount of data generated, stored, and consumed in the world. Although the scope of their estimates and therefore their results vary, all point to exponential growth in the years ahead (Hilbert and López, 2011). It is estimated that enterprises globally stored more than 7 exabytes of new data on disk drives in 2010, while consumers stored more than 6 exabytes of new data on devices such as PCs and notebooks. One exabyte of data is the equivalent of more than 4,000 times the information stored in the US Library of Congress (Brown et al., 2011). The development of the Internet in the 1970s and the subsequent large-scale adoption of the World Wide Web since the 1990s have increased business data generation and collection speeds exponentially. Recently, the Big Data era has quietly descended on many communities, from governments and e-commerce to health organisations.

With an overwhelming amount of web-based, mobile, and sensor generated data arriving at a terabyte and even exabyte scale, new science, discovery, and insights can be obtained from the highly detailed, contextualised, and rich contents of relevance to any business or organisation (Chen et al., 2012). *"Big data"* is a term that has quickly achieved widespread use among technologists, researchers, and the media. In its original form, big data referred to technical issues relating to the large volumes of data being created (Jacobs, 2009). At the same time as data volumes have increased, the cost of storing this information has reduced drastically. For example, in 2011, €500 would buy a disk drive with the capacity to store the entire world's recorded music (Kelly, 2011). In addition, two other factors, velocity and variety, are significant in big data (IBM, 2011). Velocity refers to the challenges in accessing stored data quickly enough for them to be useful. For most real-world uses, data need to be accessible in something close to real time. Offering fast access to massive amounts of data at a reasonable cost is a key limitation of existing technologies, both in terms of commonly used relational database software and the use of cheaper *"offline"* tape storage devices. Variety refers to the type of information being stored. Previously, data stored tended to be highly structured in nature.

By contrast, the types of data that tend to dominate modern data stores are unstructured, such as streams of data gathered from social media sites, audio, video, organisational memoranda, internal documents, email, organisational web pages, and comments from customers (Kuechler, 2007). From a technology perspective, the solution to the big data problem has occurred through the intersection of several innovations. These include flash-based disk drives that allow much faster access to high volumes of information, and a new generation of non-relational database technologies that make it practical to store and access massive amounts of unstructured data. Fittingly, much of this new database technology has emerged from inside companies that run social networks, including Google, Facebook, LinkedIn and Twitter (Nunan, 2013).

8.9. Further Research

With additional knowledge about the environment of organisations and the firm's Web communities like suppliers, customers, competitors, regulators, and pressure groups, analysts can better formulate a firm's strategic planning process, which can, in turn, create added value for the firm. The creation of a sustainable value proposition from both the organisational and the customer perspective is now considered to be a paramount element of strategic thinking. This ability has become a means of differentiation and a key element of the on-going struggle of finding a sustainable competitive advantage (Heskett *et al*., 2008). By adding more value to the core product, this results in improved customer satisfaction so that the bonds are strengthened and customer loyalty thereby strengthened. In the author's opinion, this is an area that still requires a lot of additional research. The value in long-term relationships with a supplier on the consumer market, is still not fully understood, and the buyer-supplier relationships in the consumer market, are areas that have been somewhat neglected within the research to date, and it therefore, represents an area of further research. Social networks also represent another area, where further research into how they can be best utilised within an organisational context needs to be undertaken. Social network analysis provides a means to assess networks and their structure as organised IS. This should make it possible to analyse relationships that are created through social networks among people, teams, departments, organisations, or even geographical regions or markets (Cross et al., 2004). Web-based services, such as Facebook or LinkedIn, also provide new ways to make interpersonal relationships more transparent and traceable, and allow researchers to study how such information is being deployed by social agents. Users can now connect with ease to their friends and business acquaintances and keep them aware of their activities. As a result, they can now probe for others in the same networks based on queries like; *"who knows someone who knows someone who knows the person"*.

8.10. Concluding Remarks

The title of this doctoral thesis is: *"Customer Relationship Management through Business Intelligence"*. The thesis contributes to and extends the understanding of ERP and BI within the workplace, and their significance in relation to developing the CRM model. Within the thesis a great deal of stress was placed upon the importance of the organisation having a strategy that supports its vision. It has been clearly demonstrated how PDV allocated substantial resources into enhancing the CRM model with the intention of building lifetime value into the organisation. This reflects the philosophy of PDV, to build and maintain long-term relationships with customers. Although BI technologies assist in these efforts, CRM is much more than just a "*Technology",* and it requires a long term commitment on behalf of the organisation to relationship building efforts.

Not all of the available technologies were mentioned, or addressed, for to do so would go beyond the scope of this thesis. However, as more and more technologies work their way through the pipeline, real-time BI will over time become commonplace and will become available to everyone across all aspects of the organisation, and will become embedded in many business systems. Although many technologies are available to implement this vision, many challenges remain to make this vision a reality. While, it is true that ERP and BI systems promise quite a lot in in terms of efficiency improvements, increased responsiveness, knowledge infusion, and adaptability, it also has to be recognised that they also suffer from a number of limitations as well, which often involves a trade-off between standardisation and flexibility. ERP and BI systems have traditionally focused on internal organisational processes, whereas, SCM applications have been introduced to enable internal organisational business processes across the supply chain. SCM management applications have become increasingly integrated in an effort to create efficiencies through tight relationships between suppliers and customers. However, because the use of BI technology has opened up a number of different channels of communication with the customer, these same channels can be used for the distribution of products, which do not enter the supply chain of PDV at all. There is now the possibility for PDV to engage with distributors and vendors of other products, such as CDs, DVDs, and books and allow PDV to market and sell these products through the PDV Website. This sort of arrangement can offer many advantages, as PDV does not have to integrate any of these products into its own supply chain, but still makes a commission on each sale. From an efficiency perspective this is a very good method to garner additional revenue at minimal cost.

Although much has been made of the tremendous contribution that various technological applications can make in assisting the strategic vision of the organisation within this thesis, it must be kept in mind, that all of these applications represent tools to be used at the discretion of management. How management use that discretion will have a large bearing on how effective these tools will turn out to be. Technology represents only one facet of the overall organisational structure, and it must be operated in a way that compliments the many other structures within the organisation. The purpose of management is to *"add value"* to an organisation through intelligent decision making. If a given set of organisations within a particular sector have similar resources and technology at their disposal, it will ultimately come down to the *"adding value"* ability of management that will determine who will be the winners, and who will be the losers. Much of this ability on behalf of management lies outside the sphere of the technology. The more successful leaders both in business and in other spheres have always been aware of this fact.

I shall leave the final words to Thomas Watson, who stated that;

"I believe the real difference between success and failure in a corporation can be very often traced to the question of how well the organisation brings out the great energies and talents of its people." - Thomas J. Watson, Jr.

This thesis started out by stating that it would demonstrate that*: "ERP and BI strategies, when correctly applied, and in combination with e-marketing and well thought out Website development, can produce a synergy greater than the effect of any individual component, which can greatly enhance the overall profitability of an organisation, in a way which has not been previously realised."* This study has advanced the extent and scope of knowledge within the field of BI and CRM within the organisational context, and the author has been able to demonstrate by the work embodied within this thesis, that the hypothesis is indeed true.

Postscript

"In Italy for thirty years under the Borgias they had warfare, terror, murder and bloodshed but they produced Michelangelo, Leonardo da Vinci and the Renaissance. In Switzerland, they had brotherly love; they had five hundred years of democracy and peace and what did they produce? The cuckoo clock." - Orson Welles

Appendices

Appendix One

ERP Vendors and Products

Vendor Company Name	Package
3i Infotech	ORION Enterprise
3rd Dimension Systems	Manufacturing Management
Abacus Data Systems	ADAMS
ABAS-USA	abas ERP
ABBASOFT Technologies	NetPartner & WebPartner
AccessIG	Pro-III Master
AccountMate Software Corporation	AccountMate for Express
AccountMate Software Corporation	AccountMate for LAN
AccountMate Software Corporation	AccountMate for SQL
AccountMate Software Corporation	Visual AccountMate
Acero Solutions	ACERO Enterprise
Activant	Prelude
Activant	Prophet 21
Adonix	X3
Advanced Business Software	ADaM
AIM Computer Solutions	AIM Vision
American Software	e-Intelliprise
AmericanERP	Automated Formula/Food Processing(AFP)
Aria Systems	ARIA Advantage Series
Avexus	Impresa
Axis Computer Systems	AXIOM
B&L Information Systems	BLIS-400
BatchMaster Software	BatchMaster Enterprise
Blue Link Associates	Blue Link Elite
Bluebird Software LLC	Bluebird Accounting
BMA Software	BMA
Bowen & Groves	M1
CIMA	CIMA
Cimnet Systems	Paradigm
Cincom Systems	CONTROL
CMS Software	CMSi5
CompuEx	CompuEx Easy Accounting
CompuEx	CompuEx Express Accounting
CompuEx	Enterprise Accounting
Computer Generated Solutions	BlueCherry Enterprise
Computer Insights	The BUSINESS EDGE

Consona	DTR Plastics ERP
Consona	Encompix
Consona	INFINACS II
Consona	Made2Manage
COSS Systems	COSS Manufacturing
Cougar Mountain Software	CMS Professional Accounting Software
Cougar Mountain Software	Denali Premium Accounting
CRC Information Systems	THE System
CSB-SYSTEM International	CSB-System
Cubicorp,LLC	Cubic ERP
CYMA Systems, Inc.	CYMAIV Accounting for Windows
Datacom International	dataSTOR
Datacor	Chempax/CS
DataModes	TM4
DBA Software	DBA Manufacturing Next-Generation
Deacom,Inc.	DEACOM
Discovery Solutions International	Discovery Management Software
Electronics For Imaging	EFI Print
EMR Innovations	ProcessPro
Enhanced Systems & Services	Finesse ERP
Enterprise Logix	Logix
Epicor Software Corporation	Epicor Financials Suite
Epicor Software Corporation	iScala
Epicor Software Corporation	Vantage
Epicor Software Corporation	Vista
Eshbel Technologies, Ltd.	Priority
ESI/Technologies	Emis
Everest Software Solutions	Everest Manufacturing Software
Exact	e-Synergy
Exact	Macola ES
Exact	Macola Progression
Exact Software	Alliance
Exact Software	JobBOSS
Exact Software	Macola ES
Exact Software	MAX ERP
Execontrol Global Solutions	EXEControl
Expandable Software	Expandable
Foresight Software	MXP
Freedom Applications	A.M.M.O.
Friedman Corporation	Frontier
General Data System	ProfitTool
Gillani	Endura iDistribute
Global Shop Solutions	Global Shop
Glovia International	glovia.com
HarrisData	HarrisData ERP
Henning Industrial Software	Visual EstiTrack

Horizon Software	MRP Plus
IFS North America	IFS Applications
IndustriOS Software	IndustriOS
InfoPower International	ERPDBO
Info-Power International	ABW
Infor Global Solutions	SyteLine
Infor Global Solutions	Adage ERP
Infor Global Solutions	Infor XA ERP
Infor Global Solutions	SSA ERP LN
Infor Global Solutions	SSA ERP LX
Infor Global Solutions	System21 Aurora
Infor Global Solutions	TRANS4M
Infor Global Solutions	VISUAL Enterprise
Infor Global Solutions	VISUAL Jobshop
Infor Global Solutions	Baan
Infor Global Solutions	Infor FMS (Financial Management System)
Ingenuity Software Corporation	Ingenuity Business Suite
Innov8 Computer Solutions	StepUp Accounting
Innovative Solutions International	EnterVision
In-Style Software	In-Style Software
Integrated Inventory Solutions	inxsql
Integrated Systems Technology	Intrust Win
International Business Systems	IBS
InterNetworkX Systems	ShopWorX ERP
Intertul	Info.Net
Intuit	Eclipse DMS
Intuit	QuickBooks Enterprise Solutions
Intuit	QuickBooks Online Edition
Intuit	QuickBooks Premier Editions
Intuit	QuickBooks Pro
Intuitive Manufactoring Systems	Intuitive ERP
IQMS	EnterpriseIQ
IT3	IT3 Workspace
Jaas Systems	JAMS
JBM Logic	INTEGRA e-business
Jobscope Business Solutions	JOBSCOPE
JOMAR Softcorp International	E+ebusiness Application Suite
Knovalent	Knovalent Automotive
Lawson Software	Lawson M3
Lawson Software	M3 Enterprise Financial Management
Lawson Software	S3 Enterprise Financial Management
ManEx	Manex ERP
Manufactoring Advisors	Catalyst Manufacturing
Manufactured & Distribution Systems	Myte Myke

Manufacturing Action Group (MAGI)	WinMAGI
Metalsoft	FabriTrak
Micron Software Systems	Hardgoods Distribution
Micron Software Systems	HDX
Microsoft Business Solutions	Dynamics AX
Microsoft Business Solutions	Dynamics GP
Microsoft Business Solutions	Dynamics NAV
Microsoft Business Solutions	Dynamics SL
Microsoft Business Solutions	Small Business Manager
Minotaur Software, Ltd.	Minotaur Business System
MISys	MISys Manufacturing System
MSI International	PowerShop ERP Software
MYOB	AccountEdge
MYOB	BusinessEssentials
MYOB	Premier Accounting Small Business Suite
NetSuite, Inc.	NetSuite
New Generation Computing	Redhorse
Nexxlink	Scoopsoft
OmegaCube Technologies	PowerERP
Open Systems, Inc.	TRAVERSE
OpenMFG	OpenMFG
Option Systems Limited	STYLEman
Oracle Corporation	JD Edwards EnterpriseOne & World
Oracle Corporation	NetLedger
Oracle Corporation	Oracle Financials (E-Business Suite)
Oracle Corporation	PeopleSoft Enterprise
Parity Corporation	ParityPro Food Enterprise
Passport Software	PBS Manufacturing Series
Peartree Software	MMS Suite
Peeriod Systems Corporation	NetCycle
Pentagon 2000 Software	Pentagon 2000
Plexus Systems	Plexus Online
Pogressive Solutions	Lumber Track
proALPHA Software Corporation	proALPHA
Profit Solutions International	Abaci
ProfitKey International	Rapid Response Manufacturing
PRONTO North America	PRONTO Xi
QAD	MFG/Pro
Qantel Technologies	QMRP
Ramco Systems Corporation	Ramco Applications
Red Wing Software	TurningPoint
RES Software	CBI
Ross Systems	iRenaissance
Rover Data Systems	Millennium III

Sage Software	Accpac ERP
Sage Software	BusinessVision
Sage Software	BusinessWorks
Sage Software	ePeachtree
Sage Software	MAS 90
Sage Software	MAS200
Sage Software	MAS 500
Sage Software	Peachtree
Sage Software	PFW ERP
Sage Software	Pro ERP
Sage Software	Sage PFW
Sage Software	Sage Pro
Sage Software	Simply Accounting
Sage Software	Timberline
SAP	Business One
SAP	mySAP All-in-One
SAP	mySAP ERP
SAP	R/3
SapphireOne Pty Ltd.	SapphireOne
Sentai Software	Trax
Seradex	Seradex Manufacturing Software
Shoptech Software Corporation	E2 Shop System
SoftBrands	evolution
SoftBrands	Fourth Shift Edition of SAP Business One
Softrak Systems, Inc.	Adagio
Software 21	FlexGen 4 - AE
SouthWare Innovations, Inc.	SouthWare Excellence Series™
Synergistic Software Solutions	JobOps
SYSPRO	SYSPRO
Syspro	Syspro ERP
Technology Group International	Enterprise 21
The Fredrick Group	TFG
TimberSoft	Woodwork for Windows
TIW Technology	shopLink
TIW Technology	WorkShop
Trakware Systems	TRAKware Software
TTW Incorporated	WinMan
Tuppas Corporation	Tuppas
Universal Business Systems	Paper Master
User Solutions	Resource Manager - DB
Vertical Systems	Manufacturing Systems
VerticalSoft	VerticalSoft 800 Series
Verticent	ERP Plus Suite
Vicinity Manufacturing	Vicinity
Visibility Corporation	VISIBILITY.net

Vision ERP Group North America	Caliach Vision
Visual 2000 International	Visual 2000 IIS
Vormittag Associates, Inc	S2K Enterprise
Vormittag Associates, Inc.	System 2000
WorkWise	TCM
Xantel	AMAPS+PLUS
Xdata Solutions	GXD
Xperia	Comprehensiv

Appendix Two

Checklists for ERP Evaluation

The exercise of evaluating ERP's becomes easier if detailed checklists of major points of interest are prepared beforehand. These checklists can be used to gather relevant information that can be analysed and used as the basis for the selection process.

- ERP vendor issues are illustrated in Table 1.
- ERP product issues are illustrated in Table 2.
- ERP technical issues are illustrated in Table 3.
- ERP installation and operation issues are illustrated in Table 4.
- ERP integration and interface issues are illustrated in Table 5.
- ERP modification and maintenance issues are illustrated in Table 6.
- ERP audit and control issues are illustrated in Table 7.
- ERP standards and documentation issues are illustrated in Table 8.

The meaning of the column headings is as given below:

- Available: indicates that the functionality is currently available as standard function in the ERP system.
- Configured: indicates that the functionality is not available as the standard functional but the ERP system can be configured easily to deliver the required functionality.
- Upgraded: indicates the functionality is planned and would become available in future named upgrades or release versions of the ERP system.
- Third-party: indicates that the functionality is not available in the ERP system but is available with third-party packages that have been specifically qualified for the ERP system.

Table 1 ERP Evaluation: Vendor Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	How long has the ERP under consideration been sold by the vendor in the market?					
2	Has it been developed in-house or acquired? Is the core development team still with them?					
3	What is the gross annual turnover and profit of the company? What is the ratio of sales to support revenue?					
4	How long has the vendor been in the packaged solution market?					
5	What is the installed base of this ERP?					
6	What are the hardware and operating systems that it is currently available on?					
7	How are they distributed: industry wise or location-wise?					
8	What is the geographical spread of the vendor's development, sales, and support offices?					
9	How many employees does the company have in technical and support functions?					
10	What are vendor's support and service policies?					
11	Does the vendor provide online modem-based support?					
12	What are vendor's training programmes and facilities?					

13	How many employees does the company have in development, technical support, training, and commercial areas?					
14	Do the company's products have user groups? How are they organised?					
15	Who are the technical and business partners of the vendor?					
16	What is the company's strategy for industry-specific solutions?					
17	Is the vendor itself ready to implement the ERP package within the company?					

Table 2 ERP Evaluation: Product Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	How many actual package users are there?					
2	How many years have they been using the package? How many locations has the package been operational?					
3	Have the users been satisfied with the package?					
4	Can the vendor provide references of companies where the ERP under consideration is in operation?					
5	Can the vendor provide details of installations at these customer sites?					
6	Can the vendor provide professional references who can be contacted in these					

	companies?					
7	Can the vendor arrange a visit to one or two sites where the package has been operational? Can this visit include detailed demos and a review of experiences, operations, and problems?					
8	Is the package user friendly?					
9	What is the product map? Is it comprehensive?					
10	Does it cover all functions of an enterprise?					
11	How scalable is the ERP in terms of the number of users that can be supported as well as its ability to be deployed as a company-wide solution?					
12	Does it follow the principle of one-point data entry?					
13	Does it have a centralized database for enterprise data?					
14	Are the transactions updates done in batch or online mode?					
15	Can it be integrated? Can its modules work in a standalone mode?					
16	How easy is it to integrate with third-party systems and solutions?					
17	Does it have an open architecture with adherence to worldwide standards?					
18	Is it based on non-proprietary technology? Can it work on standard hardware and operating system platforms?					

19	Does it follow standard protocols and interfaces? Can it interface with legacy and other systems like SCM, CRM, EDI, and so on?					
20	Does the source code come along with the system?					
21	Is it accessible for making modifications? How will modifications and corrections be made?					
22	Will modifications of the ERP be necessary to obtain efficient and effective operations?					
23	Will the ERP markedly affect other user services?					
24	How easy is it to configure the ERP to the specific requirements of a company quickly and simply?					
25	Does the system enable the uploading of data from the legacy systems used by the enterprise?					
26	Does the system have utilities for doing the data conversion?					
27	What is the cost of such utilities? What is the development status of the product? Is it slated to go through a major revamping or through major additions?					
28	Does the package contain current technological features?					
29	What is the enhancement and upgrade strategy of the					

	product?					
30	How many releases or upgrades have been introduced in the last two years?					
31	Did the releases meet your schedule?					
32	What is the design strategy for addressing migration compatibility, Euro currency, and International languages?					
33	What is the product strategy to make it Web-enabled?					
34	Does the system have e-commerce functionality or does it have third-party e-commerce solutions?					
35	What is the product strategy to introduce and enhance country-specific functionality?					
36	What is the product strategy to introduce industry-specific functionality?					
37	How often are the new releases introduced?					
38	What is the market view of the product? Has it been analysed, compared, and benchmarked?					
39	Does the package rate well in surveys?					
40	What is the cost of the package?					
41	Is the cost based on the envisaged number of users?					

42	What are the licensing policies of the product?					
43	What is the cost of additional features and modules required by the enterprise?					
44	What are the annual recurring costs?					
45	What is the cost of periodically purchasing updated versions?					
46	What is the cost of installation?					
47	What is the cost of training?					
48	What is the cost of system documentation?					
49	What is the cost of vendor support and services?					

Table 3 ERP Evaluation: Technical Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Does the ERP run on the target platform identified by the enterprise?					
2	What is the minimum configuration required for the target computer for installing the ERP?					
3	Does the package need any optional features from the OIS?					
4	Does the ERP have an application repository system?					
5	Does it have a GUI system?					

6	Does the system provide for defining default screen characteristics, function keys, fonts, and so on?					
7	Does the menu have pictures or icons? Is the status information displayed on the screen for reference?					
8	Does it have a menu management system?					
9	Is the system start up satisfactory, including date, time, operator identification, control numbers, security controls, and so on?					
10	Are there clear, brief, and well-documented instructions to guide the user through the system?					
11	Are error messages well formatted, clear, and well documented?					
12	Are the error correction options and instructions satisfactory?					
13	Are single-key action commands used to speed the interaction of the user?					
14	Does it have a help management system? Is contextual help available on a field or a programme?					
15	Does it have a database management system?					
16	Does it have facility for database reorganisation?					
17	Does the system provide direct access to the data within the database outside of the system?					

18	Are the record sizes, key structures, and other elements relatively independent of the target environment?					
19	Are the detailed layouts available for all data tables?					
20	Do the data tables contain sufficient audit trails including date changed, by whom, and the type of change?					
21	Does the system test for the existence of numbers such as account numbers, document numbers, and code numbers?					
22	Does the package have adequate input and output edits and controls?					
23	Does the package have adequate controls for maintaining the integrity of tables and data?					
24	Does it have a 4GL development system?					
25	Does it have a query management system?					
26	Does it have a report management system?					
27	Can the user select documents, formats, and fields and control the output to the screen the printer?					
28	Does it have an application administration system?					
29	Does the system provide mirroring or data replication?					
30	Can the system tolerate errors and difficulties at the terminals and					

	continue operating?					
31	Does the system save the data needed for recovery in case of power failure, entry of improper data, and so on?					
32	Are terminal users prevented from stopping, disrupting, or destroying the operation of the system?					
33	Are there simple non-destructive methods for EXIT or GO BACK or PREVIOUS SCREEN?					
34	Does it have a software distribution system?					
35	Does the system provide for defining an access Available profile at specific terminals?					
36	Does it have a configuration management system?					
37	Does the system help in guiding through the configuration system?					
38	Does it have a change management system?					
39	Does the system have facilities to control the release of new or changed programmes into production?					
40	Does it have a version management system?					
41	Does it have a security and administration system?					
42	Does the system provide for defining and maintaining access profiles and passwords?					
43	Does it have an audit					

	management system?					
44	Does it have a disaster recovery system?					
45	Does the system provide automatic recovery procedures?					
46	Does it have an archival management system?					
47	Does it have a communications management system?					
48	Does it have an API system?					
49	Does it have an online documentation system?					
50	Does it have a powerful search facility as well as suggestions on related topics?					
51	Does it have a print documentation system?					
52	Does it have an online tutorial, training, and demonstration system?					
53	Does it have an office automation system?					
54	Does it have a facility for voting?					
55	Does it have a GroupWare and Workflow system?					
56	Does the Workflow system interface with the e-mail system?					
57	Does it have a data warehouse and data analysis system?					
58	Does it have an implementation project management system?					
59	Does the system report on missed milestones, schedules, and so on?					

Table 4 ERP Evaluation: Installation and Operation Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Are the vendor's and purchaser's installation responsibilities clearly defined?					
2	Are installation specifications defined clearly?					
3	Does the vendor have a manual or computer-assisted installation procedure?					
4	Does the configuration of the installation depend on the specifics of the enterprise and is there enough assistance available via documentation or vendor personnel?					
5	Are the acceptance criteria clearly defined?					
6	Does the operation of the system need extensive training for computer operators and system programmers?					
7	Does the vendor provide sample operating standards and procedures that can be adapted and used?					
8	Does the system documentation conform to the installation's documentation standards?					
9	Can the system be installed in the operating system environment, database, LAN, and so on without major modifications?					
10	Are the system's performance criteria for acceptance clearly stated?					

11	Does the vendor promise full support until the system is installed satisfactorily?					
12	Will the vendor be available for the data conversion effort?					

Table 5 ERP Evaluation: Integration and Interface Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Does the ERP system provide an interface to its database?					
2	Does the ERP system provide an interface to other databases and systems?					
3	Does the ERP system conform to known communications protocols and standards?					
4	Does it conform to known standards of encryption?					
5	Does the system provide online or batch interfaces?					
6	Does the system provide for controlling the upload of data into the system?					
7	Does it provide facilities for quickly mapping the external data into the system tables and vice versa?					
8	Does the system provide for defining and scheduling the upload or download of data in an online mode?					
9	Does the system provide a report or audit trail on the transfer of data?					

10	Does the system provide an interface with e-mail?					
11	Does the system provide an interface with the workflow system?					
12	Does the system provide an automatic interface for loading data into a data warehouse system?					

Table 6 ERP Evaluation: modification and Maintenance Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Can the system function on an as-is basis without modification?					
2	Can the users change the administrative procedures to suit their requirements?					
3	Are all the system requirements defined through parameters and tables, making modifications easy to accomplish?					
4	Does the vendor inform others that customers have made similar modifications that may be available rapidly?					
5	Are customers advised of outstanding problems that other users have discovered?					
6	Are new releases available regularly and automatically to all the purchasers?					
7	Can a system dump be sent to the vendor for review?					
8	Does the vendor provide onsite support and maintenance?					

9	Will the vendor support an installation that has the package modified by a customer?					

Table 7 ERP Evaluation: Audit and Control Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Does the system have adequate backup if the operational version of the system is destroyed? Are all transactions properly recorded at the point of origin?					
2	Does the system have controls to ensure that all data recorded enter the computer for processing?					
3	Does the system provide for determining the proper authorization of transactions?					
4	Does the system provide facilities to ensure that all data received by the system are accurate and complete?					
5	Can the system ensure the complete and accurate processing of data through the system?					
6	Does the system provide controls to detect the loss of data or non-processing of data?					
7	Does the system ensure that all transactions are recorded in the proper accounting period and also posted to the proper records?					
8	Can the system ensure that the organisation's procedures and processing rules have been followed?					

9	Can the system ensure that the data in the tables are accurate and complete?					
10	Does the system have information on when the file was created, modified, by whom, and for what purpose?					
11	Does the system provide safeguards such as passwords or authorized terminals, to protect the tables from unauthorized access?					
12	Does the system ensure that the processed data do not include unauthorized alterations?					
13	Does the system have controls to ensure that all the errors detected by the system get corrected?					
14	Do the transmitted messages include sufficient identification including the message number, terminal, date, transaction type, and so on?					
15	Does the system maintain logs to ensure that lost or garbled messages can be recreated?					
16	Does the system retain information to permit the reconstruction of transactions to prove the accuracy and completeness of the processing?					

Table 8 ERP Standards and documentation Issues

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Does the package have standard documentation that is available online and in printed form?					
2	Does the package provide documentation on the system's functionality, technical design, and operating environment?					
3	Is the documentation easily referenced?					
4	Does the system provide extensive cross-referencing facilities?					
5	Does the system provide the capability to automatically change the relevant documentation when making modifications in the system, such as to tables, fields, screen formats, and report layouts?					
6	Does the user documentation have clear representations of menus, screens, and so on?					
7	Does the system provide the ability to prepare relevant training material on the modified system?					
8	Does the system describe the programming standards and procedures in sufficient detail to establish conformity and make documentation easy?					
9	Does the system enable easy maintenance of the modifications in the system as					

	well as the corresponding documentation?					

Table 9 ERP Functional Requirements: General Ledger Accounting

#	Description	Available	Configured	Upgraded	Third-Party	Absent
1	Does the system provide a chart of accounts? Does it have a provision for sub codes within this?					
2	Does the system provide multiple levels when producing reports and summaries?					
3	Does it provide sub ledger facilities for designated accounts?					
4	Does the system provide for recording, validating, and posting accounting transactions?					
5	Does the system provide for printing documents created in the system?					
6	Does the system provide for generating document wise registers (payment vouchers, receipt vouchers, debit notes, credit notes, journal vouchers, and so on) and account-wise summaries (general ledger accounts, and so on)?					
7	Does the system provide bank reconciliation with automatic batch- and screen-based matching?					
8	Does it provide interfaces for bank data and cash flow systems?					
9	Does the system provide for securing data on posting and					

	update account balances on posting?					
10	Does the system provide for analysing party accounts and report on the same?					
11	Does the system provide follow-up letters and details for a confirmation of balances?					
12	Does the system enable system-generated entries?					
13	Does the system provide for a generation of standard, recurring entries?					
14	Does the system provide for the planning and analysis of variances?					
15	Does the system provide reporting on variances?					
16	Does the system provide for consolidated reports and inquiries at all levels of the organisation?					

Additional Considerations

Vendor Considerations	
Vendor size	Does the vendor's size relate to the scales of our company?
Complexity	Is the ERP system too complex, or is it a good fit? Does it fit our requirements, or is it too powerful and complex in terms of the company's requirements?
Cost vs. budget	What is the total cost of the programme? Is the total cost acceptable in terms of the company's resources and budget?
Domain knowledge	What is the provider's target domain and market? Does it match to our business needs?
Flexibility	Is the technology flexible enough to meet on going requirements?
Covering requirements	Do the system and its modules cover all our requirements, now and into the future?
Fundamental	What are the requirements in terms of a database and hardware which are necessary to support the system?
Information technology	Does the vendor provide other information systems, such as Supply Chain Management, Customer Relationship Management, Data Warehousing, and e-commerce? Does the vendor widely integrate its system with other partners' information systems?
Implementation methodology	What is the implementation methodology? 2. Is it user friendly, or does it have a steep learning curve?
Service maintenance	Who supports upgrades and maintenance? The software supplier or the reseller? Does the vendor have any local service point or a branch company?
Consulting service	Does the vendor provide consulting services? Does it cooperate with another consultant company?
Financial consideration	How did the vendor perform financially over the last two years? What is its current financial forecast? Does it have any venture investment or warning signs?
How does the proposed solution support my style of manufacturing?	Manufacturers of complex, highly-configured systems can't use the same interface as someone who runs highly complex operations The solution chosen in any particular circumstance must support the particular style of manufacturing business model that is currently being employed.
Can a non-programmer develop a new business process in the system?	With most software configurations, users can make minor changes to a selected subset of screens, but new screens and process flows must be designed and programmed by programmers, adding complexity to the system. The system should support software models that

	enable normal business users to create entirely new business processes tailored to their needs.
How does the system support the "extended enterprise"?	The system should be transparent to both the customer and supplier. Additionally, the interface to the system should be intuitive enough that suppliers and customers will not need additional training to be able to use it effectively.
How is the software licensed?	Initially the software may be licenced to key personnel within the organisation, which helps in reducing overall costs; however, once the software is deployed throughout the enterprise, the requirement for additional personnel to have access to the system, and the requirement for additional licences manifests itself. Manufacturers, not being accustomed to these systems tend to grossly underestimate this number.
How many ways of accessing the system are there? Is the user interface consistent throughout the application?	Many of the legacy ERP vendors will describe all of the different client applications they have developed; for Windows XP, Mac, Linux, and for mobile devices. This tends not to be an optimal situation. Each software package must be tested and deployed, and then maintained and upgraded according to its own schedule, and this can mean that features in one client package are not exactly duplicated in another application. The solution is to standardise on a web browser as an interface, accessible from virtually any PC or device with a web connection.
When and how was the original code base developed?	Many well-known ERP products have not been rewritten since the late 70s or early 80s. There have been dramatic and important improvements in software development tools over the past several decades. A modern, supportable system should have a code base developed within the current decade. Be careful to differentiate between the "front-end" and the business logic. The front-end or user interface can be enhanced or modified quickly, giving users the impression that it belongs to a modern application, while the original code is still in place underneath the interface. Such a system is difficult and expensive to maintain and enhance.
How many customers are on the latest release of the software and when was the latest release?	This is especially important because the traditional method of delivering software can be somewhat inefficient. Upgrades tend to be provided within a six to twelve month timeframe. Customers must then evaluate whether the enhancements are meaningful to them, and whether the updates will conflict with any customisations that have already been made within the existing system. Additional time will then be required for planning, hardware upgrades, operating systems patches, migration, testing, retraining and bug-fixing, and eventually the customer may be left wondering if it was all worth the disruption to their business.

How are lean principles supported in the system?	The standard approach to software when implementing a lean program is to allow individual departments or functions to select the application that best meets their individual needs. This department empowerment is core to any lean program; however, many companies embracing lean principles still choose to implement enterprise solutions simply because the advantages offered by a system that spans multiple departments can be very appealing. The essential requirement in this respect is that the system should assist in removing waste out of the entire system both internally and across the supply chain.
How does the detailed data about production, scrap, downtime, labour and quality inspections get into the system?	These are the most important factors affecting profitability. If data is captured and validated as the activities are occurring, virtually everyone in the organisation will have accurate, timely information for decision-making. Ideally, the system will be integrated "from the shop floor to the top floor". Data will be captured and validated in real time, summarised and instantly available to decision makers throughout the organisation, wherever, they may be and regardless of the role they have. Today's manufacturing solutions should enable shop floor workers to be knowledge workers.
Are inventory records directly tied to physical reality?	Many software solutions focus on the accounting transactions. There can be a big disconnect between the physical reality and the cash equivalent in the general ledger.

System Evaluation Considerations

Do your organisation's business leaders support the ERP implementation project?	Are they involved in deciding which business processes are included in the ERP package, how to phase in the rollout, and how to measure success with the implementation? For ERP to succeed, executives throughout the organisation, especially those heading up the various departments that will use the ERP applications, must be a part of the rollout.
Who are the line-of-business professionals that can be responsible for measuring the benefits relevant to their department's ERP modules?	Employees beyond the IT department need to own the success of the ERP deployment.
Who will be the ERP programme manager?	An outside consultant or, preferably an in-house expert, should be in charge of managing the process to choose an ERP solution; coordinating demos and consultations with vendors; leading a team of representative from each area of the company, including finance, sales, human resources and manufacturing; and coordinating meetings between the key users of the system.
What are the specific business	Is the requirement to shorten product lead times or

problems you need to solve with ERP?	improve communications with your suppliers? Are there industry-specific regulations to which your company must adhere?
What are the goals and metrics that you will use to measure the business benefits of your organisation's new ERP solution?	These are usually items such as; inventory accuracy, cost reductions that your organisation is already tracking.
Is the prospective ERP solution built with SOA capabilities?	Service Orientated Architecture (SOA) allows for a more agile and flexible IT environment, connecting systems and automating manual business processes.
Which users across your organisation will need to be trained on the new system?	The success of the ERP implementation will largely depend on end-users' ability, and willingness to adopt it.
Does your ERP solution integrate, using standard technologies, with other mission critical applications?	Enterprise Integration is an absolute must for controlling costs, management support, customer and supplier management, business intelligence and enterprise readiness and continuity.
What applications does your company require to complete your ERP solution that must be satisfied by 3rd party software and hardware?	Such as barcode, warehouse management, CRM, analytics, reporting, e-commerce and Software as a Service (SaaS).
Is your ERP Solution packaged or modular?	When considering the overall end-costs for the first year, how has the solution been packaged?
What implementation methods are being considered and what tools are being brought forward to manage the people and processes?	Considering that implementation may take some time, it is critical that the completion phase is visible from the start. All charted paths and processes must be fully documented and spelled out.
Will the ERP package be able to adapt to changes in your business as your company grows?	Understanding the future growth keeps a business adaptable.
Ensure that the ERP product is web based.	The ERP product should run in a browser like Internet Explorer. If it doesn't, it is not a web based ERP. Web based ERP will allow you to seamlessly work with multiple branches in real time without any investment in hardware or connectivity.
Ensure that ERP is running on an RDBMS?	Ensure that your ERP back-end is either SQL Server or Oracle. Do not fall for relatively new concepts like OODBMS and flat file systems. These are relatively new concepts to handle light data, unlike RDBMS which can handle terabytes of information.
Ensure that you see the infrastructure of your ERP vendor.	Establish the vendor's infrastructure and establishment to ensure that it is reflective of the support and relationship that is required.
Make sure you take at least one client reference where the product is already running live.	Try to talk to at least one satisfied customer, and try to see a broadband demo of the web based solution.

Take a thorough demo of the ERP product. This is a must.	This is the most critical part of your evaluation process. You should see a thorough demo of the ERP solution. Tell the vendor to show each and every module in detail and try to relate it to the business. Try to understand what the GAP is and how much customisation is required.
Buying the solution from a Financial Accounting package seller can put you into lot of trouble.	ERP requires implementation expertise. Some vendors are selling Financial Accounting Packages along with Inventory and Payroll in the name of ERP. Buy your solution from a company that is experience in implementing ERP.
Try to meet the Owner/Project Director/ Marketing Director of the company before investing.	Talking to people who have a stake in the company will always give you confidence. You should meet them and try to evaluate their vision and experience.
Evaluate the experience of the implementation team.	You should meet the implementation head and evaluate the implementation experience of the team. Evaluate whether they have the required business knowledge.
Go through the product documentation.	Technical documentation is something which can be misleading. Try to evaluate each and every feature mentioned in the document with the product during the demo.
Evaluate the technical strength of your vendor.	Many small vendors have closed their operations, primarily because the owners of the company were not technical people. The leader of the team should be a highly technical person. This ensures that he is not dependent on his people.
Find out if the solution is being implemented by partners.	Some ERP vendors assign your account to partners and the partners do the implementation, customisation and support activities. In some cases, partners have no experience of implementation. Try to ensure that your solution is implemented only by people who have developed it.
Make sure you are buying a product and not a development platform.	Some ERP products need to be heavily customised. Those products are actually development platform on which vendors develop and deploy solutions. The development platform is provided by the parent company and further development is done by partners. You should ensure that you are investing in a product, not in a development platform.
Establish and validate the support infrastructure of your ERP vendor	Can your ERP vendor give you remote desktop support? Ensure that your vendor gives you a demonstration of remote support.
Ensure that the system is reliable & scalable by identifying the underlying technology. Ensure that the system is web based and is built on a latest technology which is proven and robust.	

Who and what do you need for an implementation?

Project Manager	This person must create and manage the project schedule, tasks and communication.

Implementation/Core Team	The core team should consist of a cross functional group that understands your business, the project goals and knows the history of the organisation.
Systems	Determine what systems are required to support the new application, and what interfaces are required to other applications.
Business Processes	Verify that current processes are documented. These will be the baseline to determine how well the new application meets your business requirements and how the new application will impact current processes.

What will the project team do?

Scope Management	The scope of the programme should be defined before it begins.
Communication	The programme manager must coordinate communication between team members to ensure that all parties know what is expected of them and when tasks / assignments are due.
Risk Management	If the scope of the project changes, determine the associated risk.
Business Process Impact Analysis	Determine how business processes will change with the new application.
Process Ownership	The core team should take ownership of their functional areas. This ownership encompasses communication, coordination with subject matter experts, and using their insights to identify how new functionality or processes will affect other departments and/or business processes.

How will the project team achieve a successful implementation?

Formal Training	During this phase, each functional area receives formal training. It normally includes key users who are part of the implementation team and are subject matter experts. Formal training should include hands-on workshops.
Pilot Testing	This is one of the most significant areas of the implementation and is conducted at two levels: 1 functional area, 2 cross functional teams. It allows testing new functionality, identifying business processes changes, proposing solutions, validating and proposed business processes changes.
Documentation	One of the most valuable tools that the implementation team can have is documentation that is customised to fit the business environment. Normally, this is accomplished by each functional team validating and documenting their business processes through the testing phase.

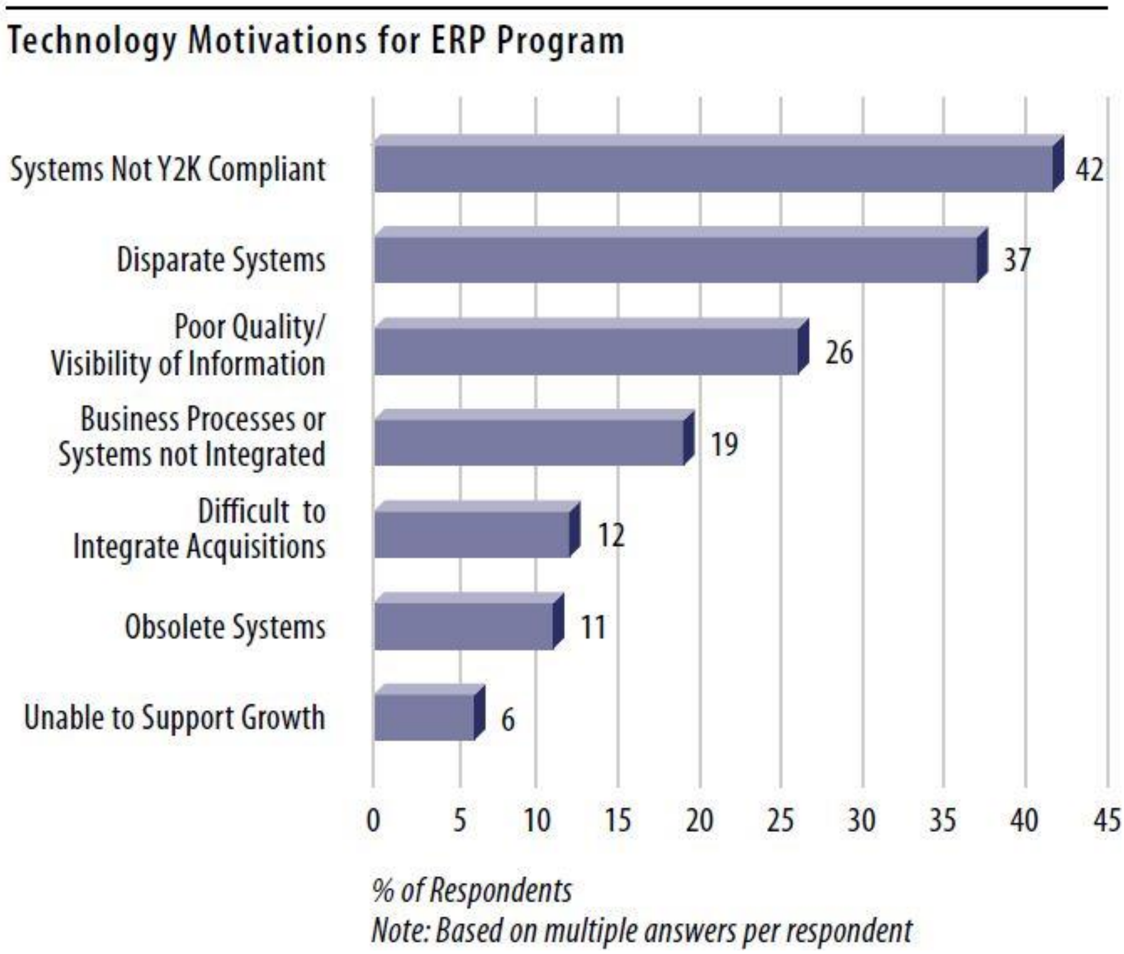
Implementation Considerations

Why are you implementing a new ERP application?
What are the driving factors?

Have you identified the most important business reasons for implementing a new application?
Has an evaluation and/or analysis of various ERP applications been conducted?
Have stumbling blocks to beginning an implementation project been identified?
What are the deciding factors to move forward with the implementation?
What are the final expectations of an implementation programme?
Has sufficient time been allocated to the project during the implementation?
How long do you expect the implementation project to take?
Has a budget been drafted or approved for the project?
What does that budget cover?
How long has the vendor under consideration been selling the ERP in the market?
Has the vendor developed the ERP in-house or is just a channel partner of the main company.
If the ERP is developed by the vendor, is the ERP development team still with the vendor or have they moved on?
It is important to do some research on the financial position of the vendor. Establish the facts in relation to the gross annual turnover and profit of the vendor company, and other financial measures, such as the ratio of revenue from support services with respect to sales.
How long has been the vendor in existence?
How many installations of the ERP product are in operation?
How good is the support network of the vendor in consideration? Does the vendor have a good network of sales and support offices?
Does the vendor company have a sufficient number of employees in their support and technical functions?
What are vendor's support and service policies?
Does the vendor provide online support for the ERP?
Will the vendor provide training programs to train the employees in the functionalities of the ERP?
Is the vendor solution well accepted in the within the marketplace?
Are there online support / user groups or forums which help in resolving problems?
Is there industry specific solution available within the ERP under consideration? If yes, does the vendor have a sufficient number of industry specific installations to vouch for the success of such solutions?
Does the vendor itself implement the ERP or will it take help from another third party company for implementing the ERP?
What features and functions do you need from a new ERP solution that will help increase users' productivity and provide access to the business data users most need?
Are there best practices you need to adopt with the ERP implementation? If your organisation operates around the world, are there foreign currencies and languages that your ERP solution must support?

Appendix Three

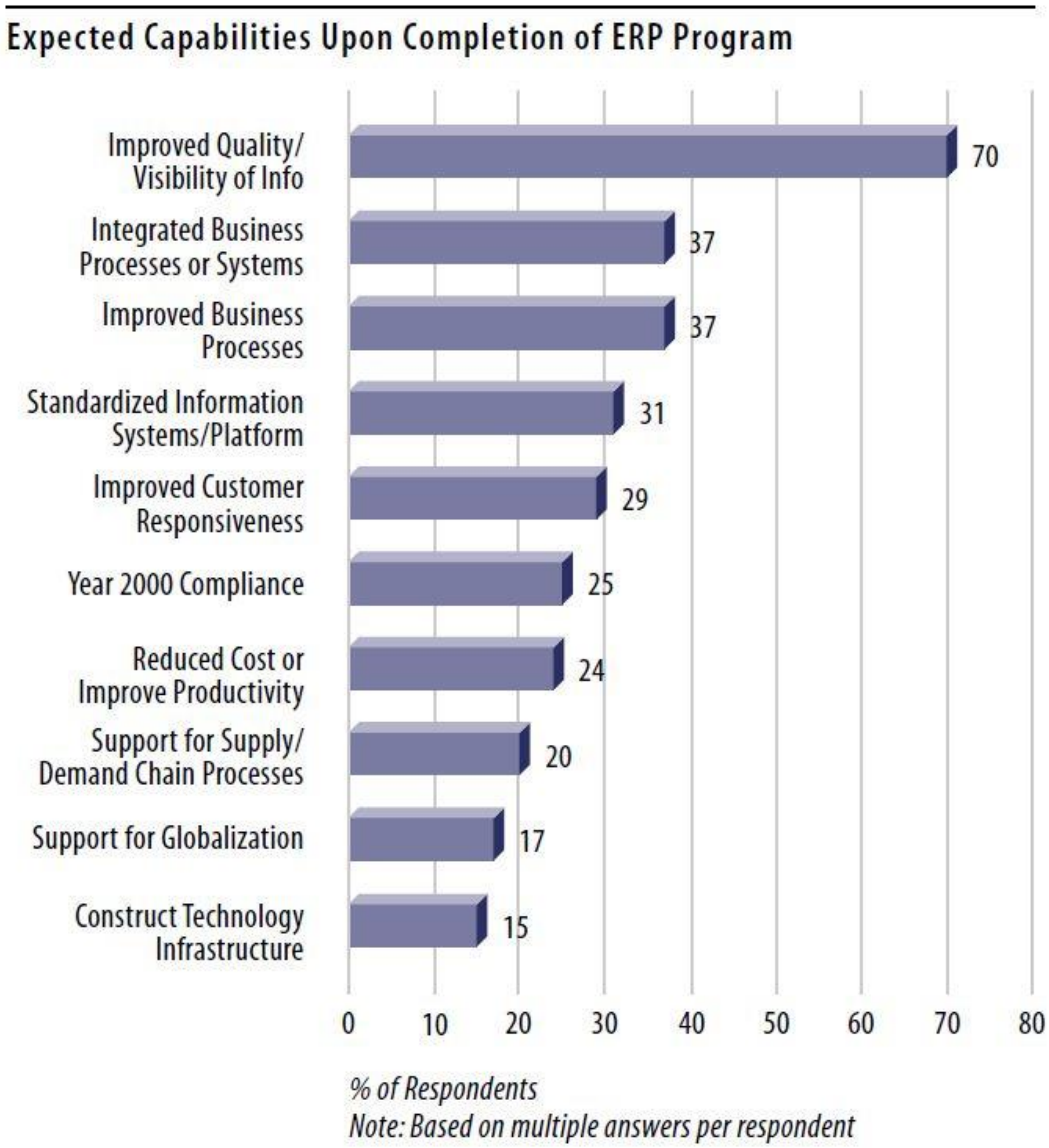
Deloitte-Benchmarking Partners Survey



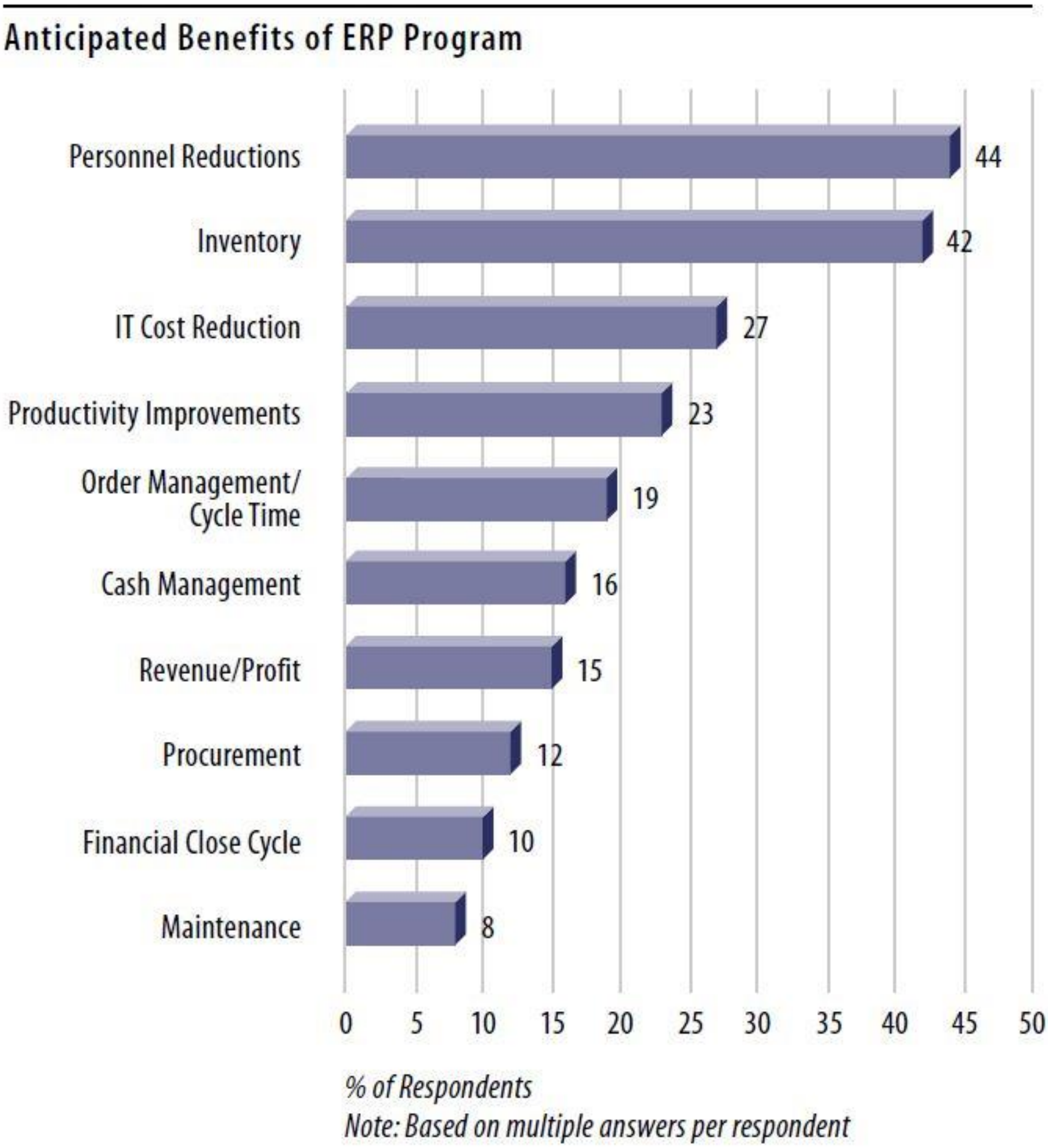
D1


Operational Motivations for ERP Program
Poor/Uncompetitive Business Performance
27
Cost Structure Too High
24
Not Responsive Enough to Customers
21
Complex, Ineffective Business Processes
20
Unable to Support New Business Strategies
15
Business Becoming Global
15
Inconsistent Business Processes
10
0
5
10
15
20
25
30
% of Respondents
Note: Based on multiple answers per respondent

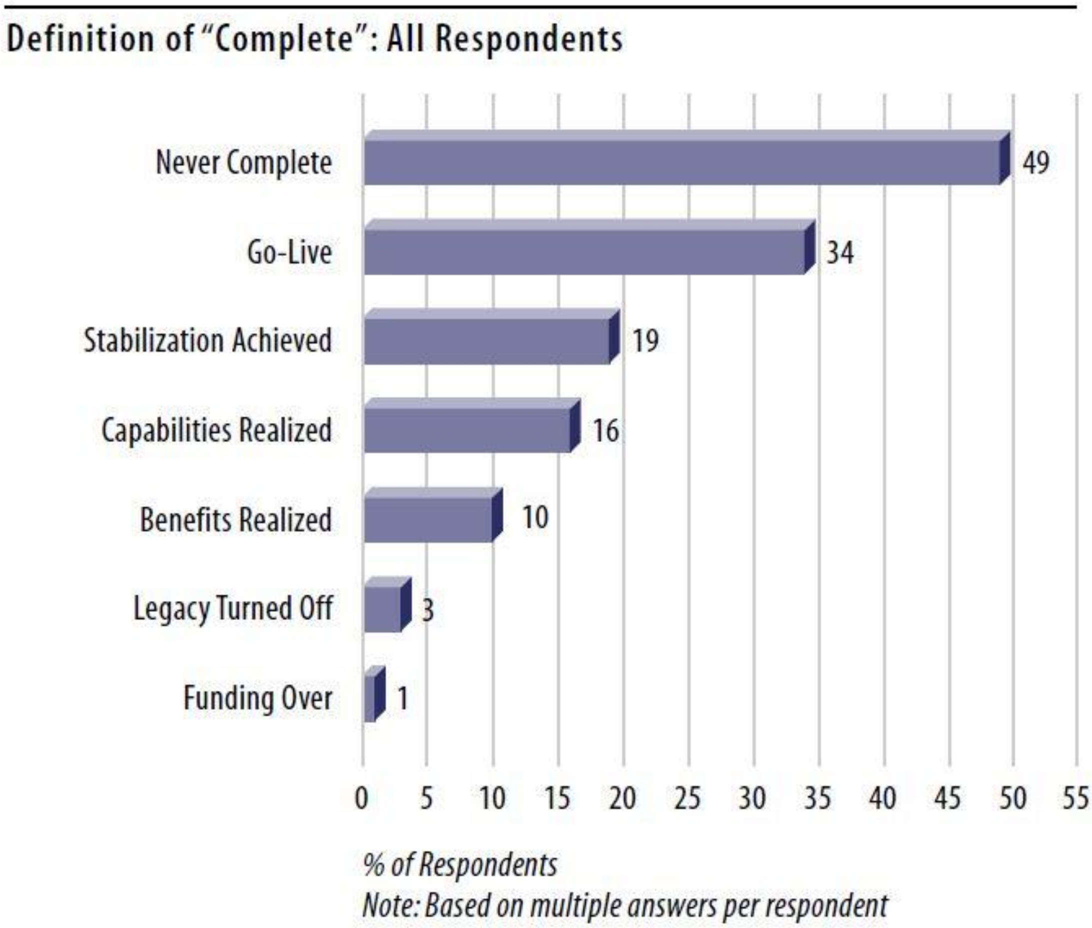
D2


Expected Capabilities Upon Completion of ERP Program
Improved Quality/ Visibility of Info
70
Integrated Business Processes or Systems
37
Improved Business Processes
37
Standardized Information Systems/Platform
31
Improved Customer Responsiveness
29
Year 2000 Compliance
25
Reduced Cost or Improve Productivity
24
Support for Supply/ Demand Chain Processes
20
Support for Globalization
17
Construct Technology Infrastructure
15
0
10
20
30
40
50
60
70
80
% of Respondents
Note: Based on multiple answers per respondent

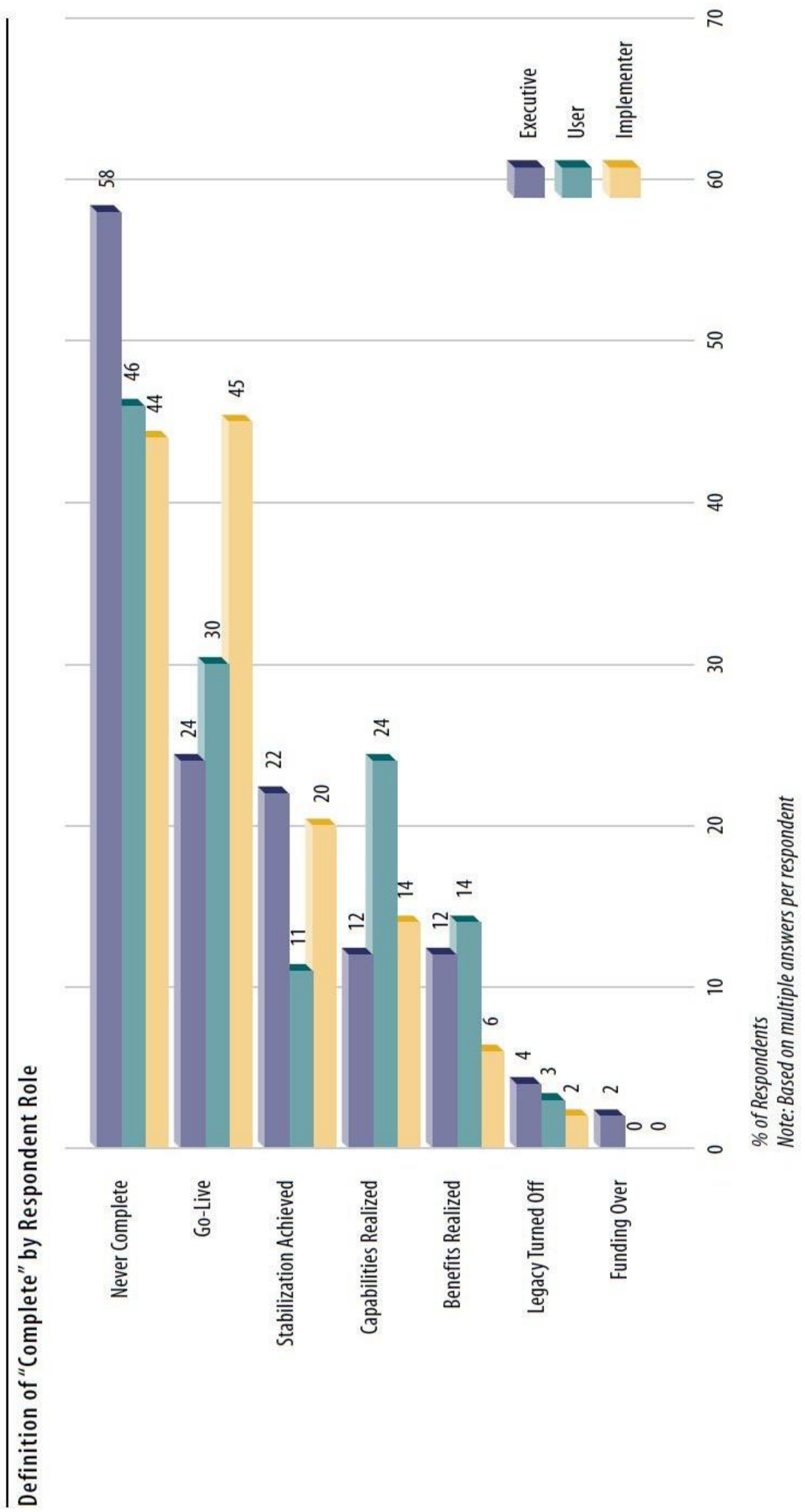
D3


Anticipated Benefits of ERP Program
Personnel Reductions
Inventory
IT Cost Reduction
Productivity Improvements
Order Management/ Cycle Time
Cash Management
Revenue/Profit
Procurement
Financial Close Cycle
Maintenance
44
42
27
23
19
16
15
12
10
8
0
5
10
15
20
25
30
35
40
45
50
% of Respondents
Note: Based on multiple answers per respondent

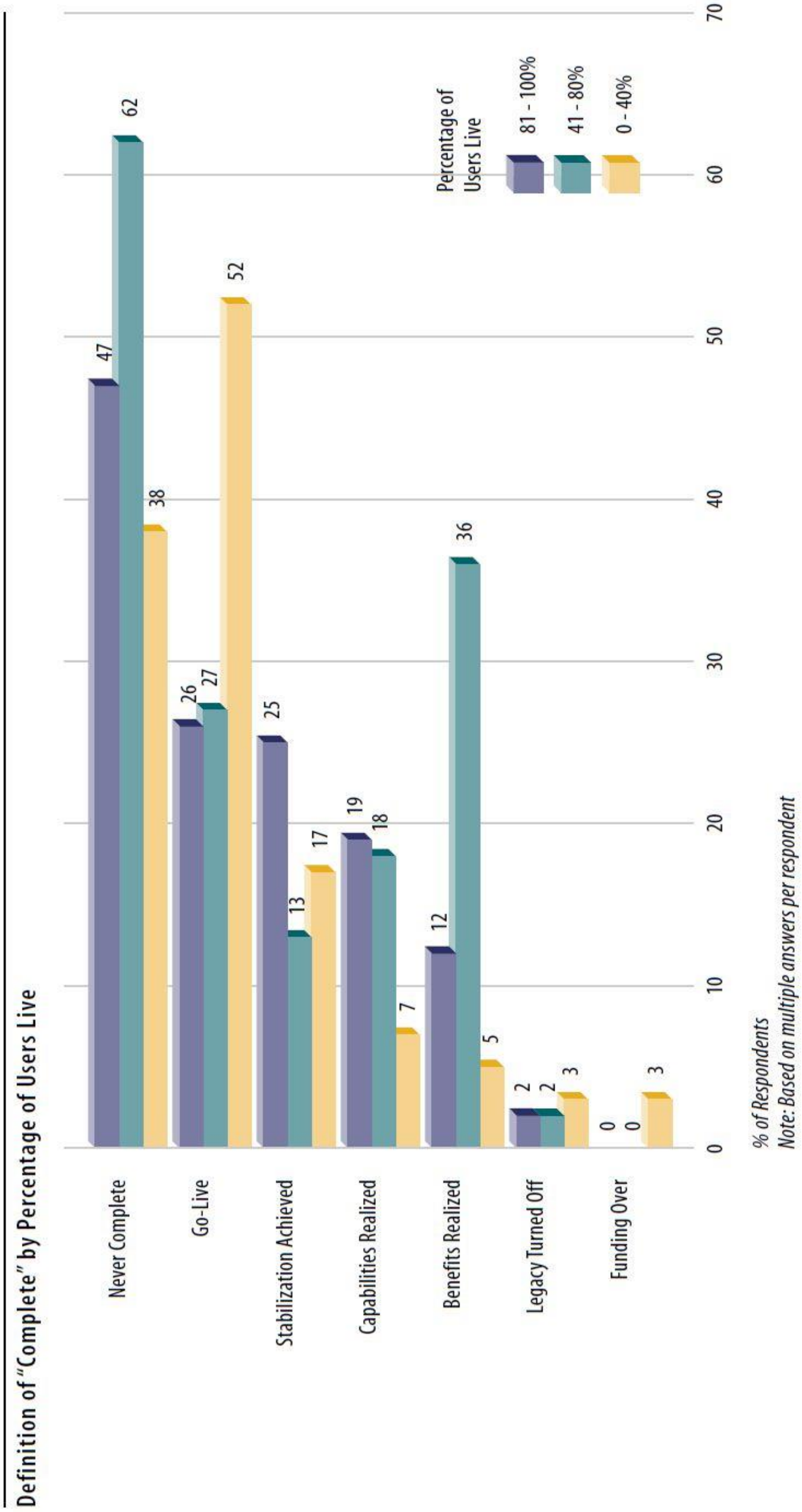
D4


Definition of "Complete": All Respondents
Never Complete
Go-Live
Stabilization Achieved
Capabilities Realized
Benefits Realized
Legacy Turned Off
Funding Over
49
34
19
16
10
3
1
0
5
10
15
20
25
30
35
40
45
50
55
% of Respondents
Note: Based on multiple answers per respondent

D5

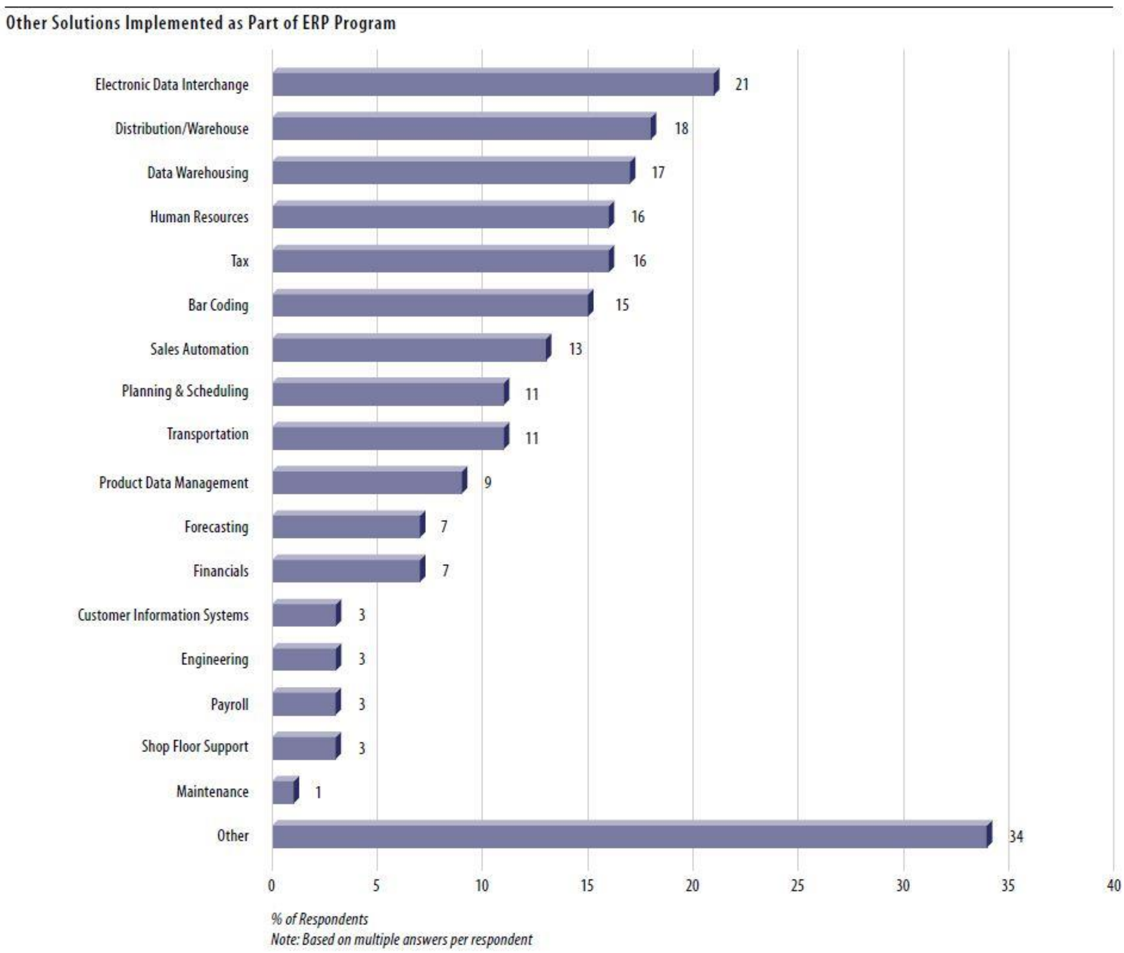

Definition of "Complete" by Respondent Role
Never Complete
Go-Live
Stabilization Achieved
Capabilities Realized
Benefits Realized
Legacy Turned Off
Funding Over
58
46
44
24
30
45
22
11
20
12
24
14
12
14
6
4
3
2
2
0
0
Executive
User
Implementer
0
10
20
30
40
50
60
70
% of Respondents
Note: Based on multiple answers per respondent

D6



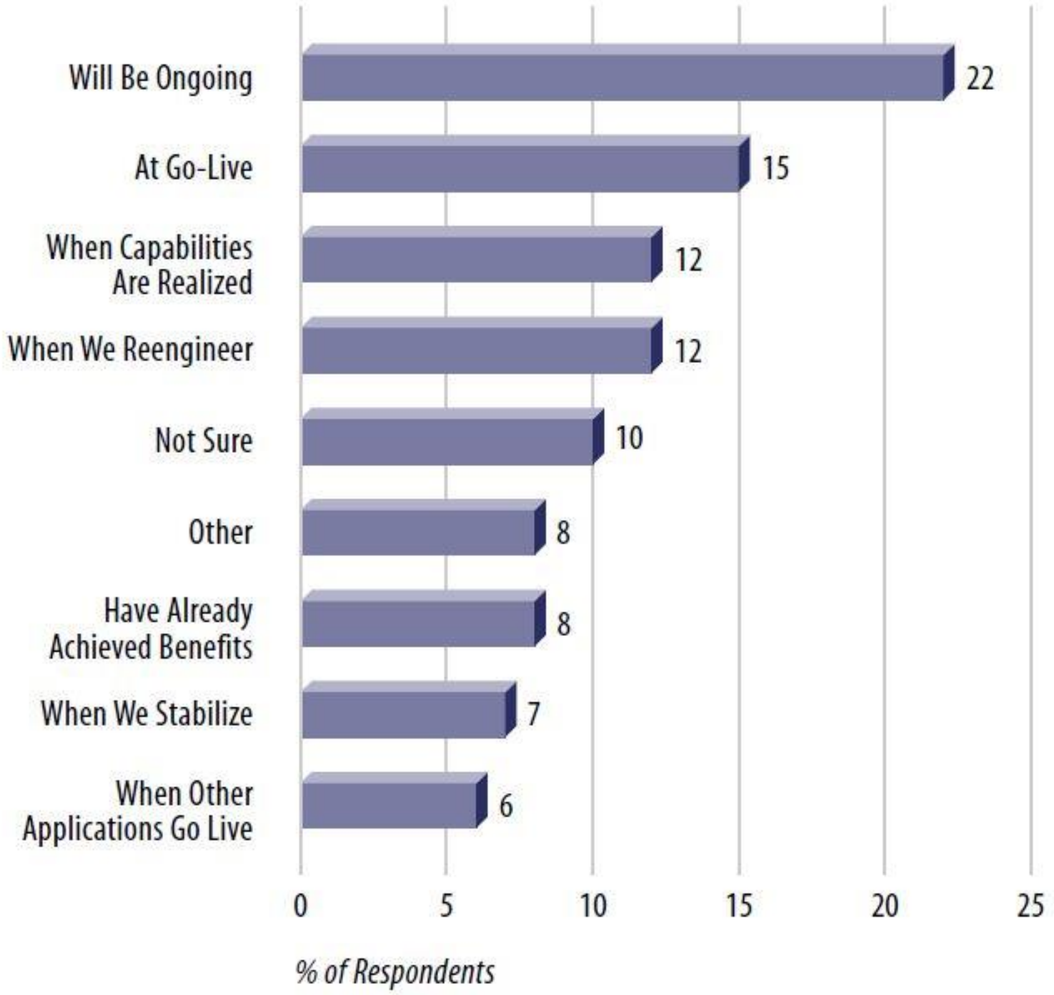
Definition of "Complete" by Percentage of Users Live
Never Complete
Go-Live
Stabilization Achieved
Capabilities Realized
Benefits Realized
Legacy Turned Off
Funding Over
47
62
38
26
27
52
25
13
17
19
18
7
12
36
5
2
2
3
0
0
3
0
10
20
30
40
50
60
70
% of Respondents
Note: Based on multiple answers per respondent
Percentage of Users Live
81 - 100%
41 - 80%
0 - 40%

D7

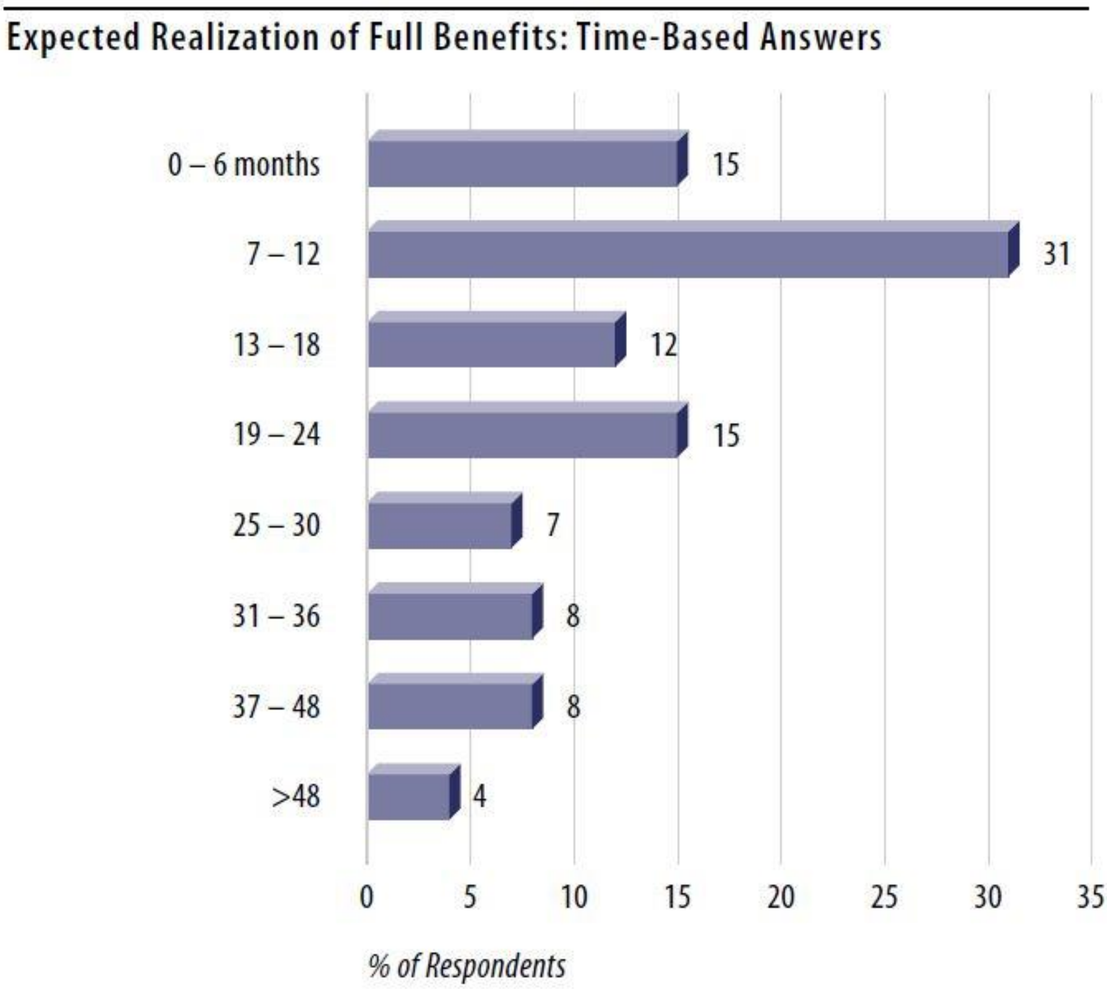

Other Solutions Implemented as Part of ERP Program
Electronic Data Interchange
21
Distribution/Warehouse
18
Data Warehousing
17
Human Resources
16
Tax
16
Bar Coding
15
Sales Automation
13
Planning & Scheduling
11
Transportation
11
Product Data Management
9
Forecasting
7
Financials
7
Customer Information Systems
3
Engineering
3
Payroll
3
Shop Floor Support
3
Maintenance
1
Other
34
0
5
10
15
20
25
30
35
40
% of Respondents
Note: Based on multiple answers per respondent

D8

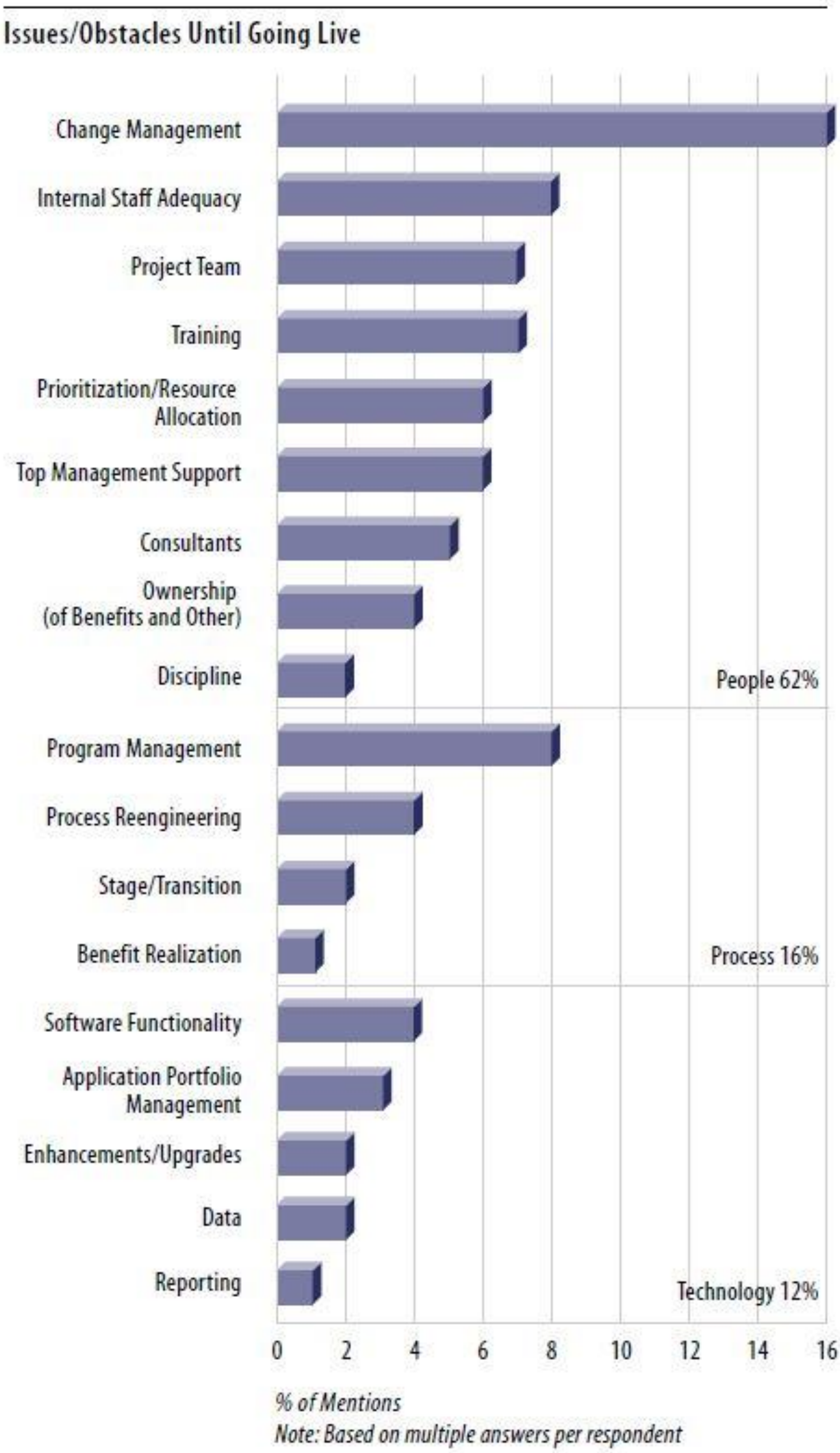
Expected Realization of Full Benefits: Event-Based Answers



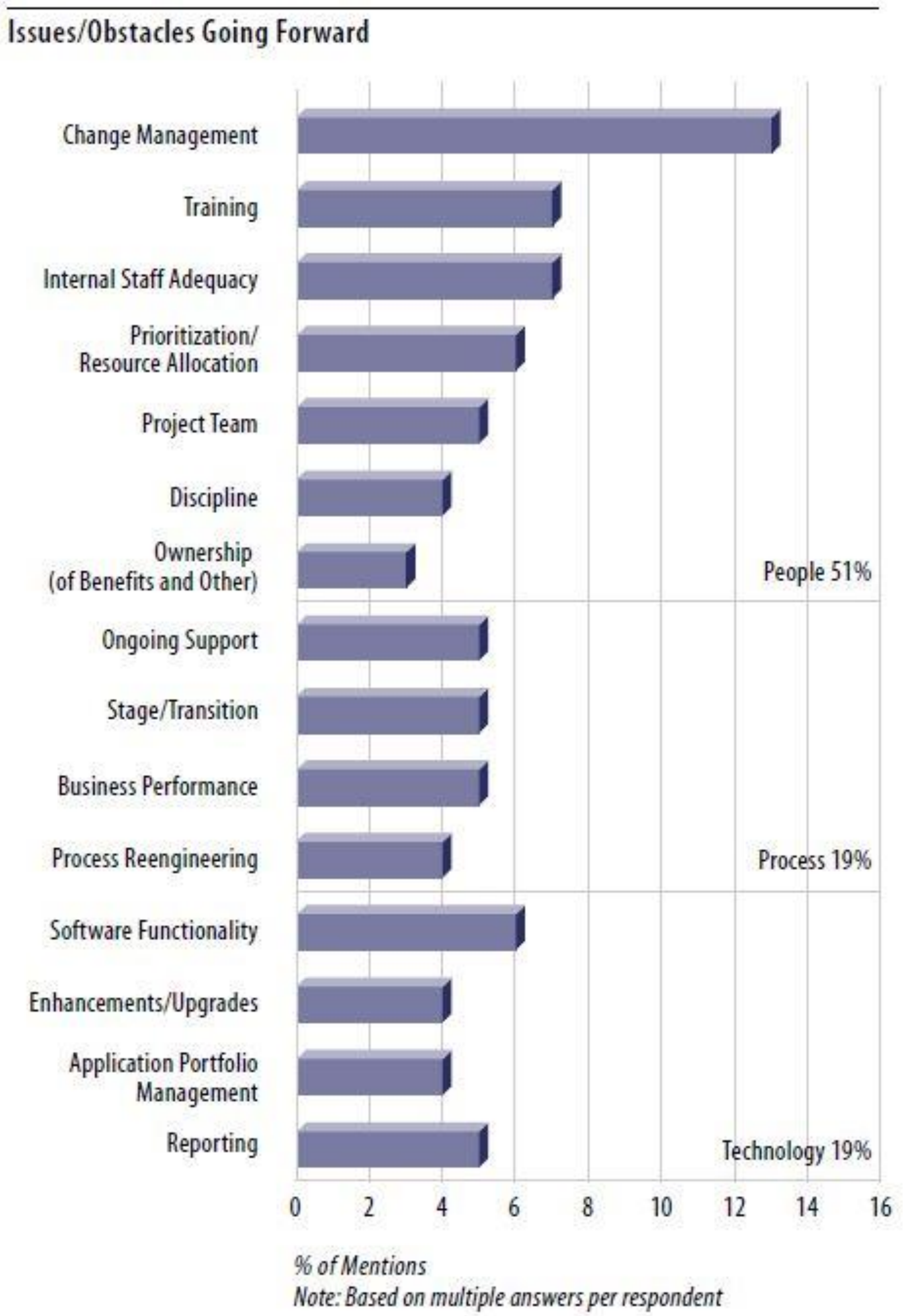
D9


Expected Realization of Full Benefits: Time-Based Answers
0 – 6 months
7 – 12
13 – 18
19 – 24
25 – 30
31 – 36
37 – 48
>48
15
31
12
15
7
8
8
4
0
5
10
15
20
25
30
35
% of Respondents

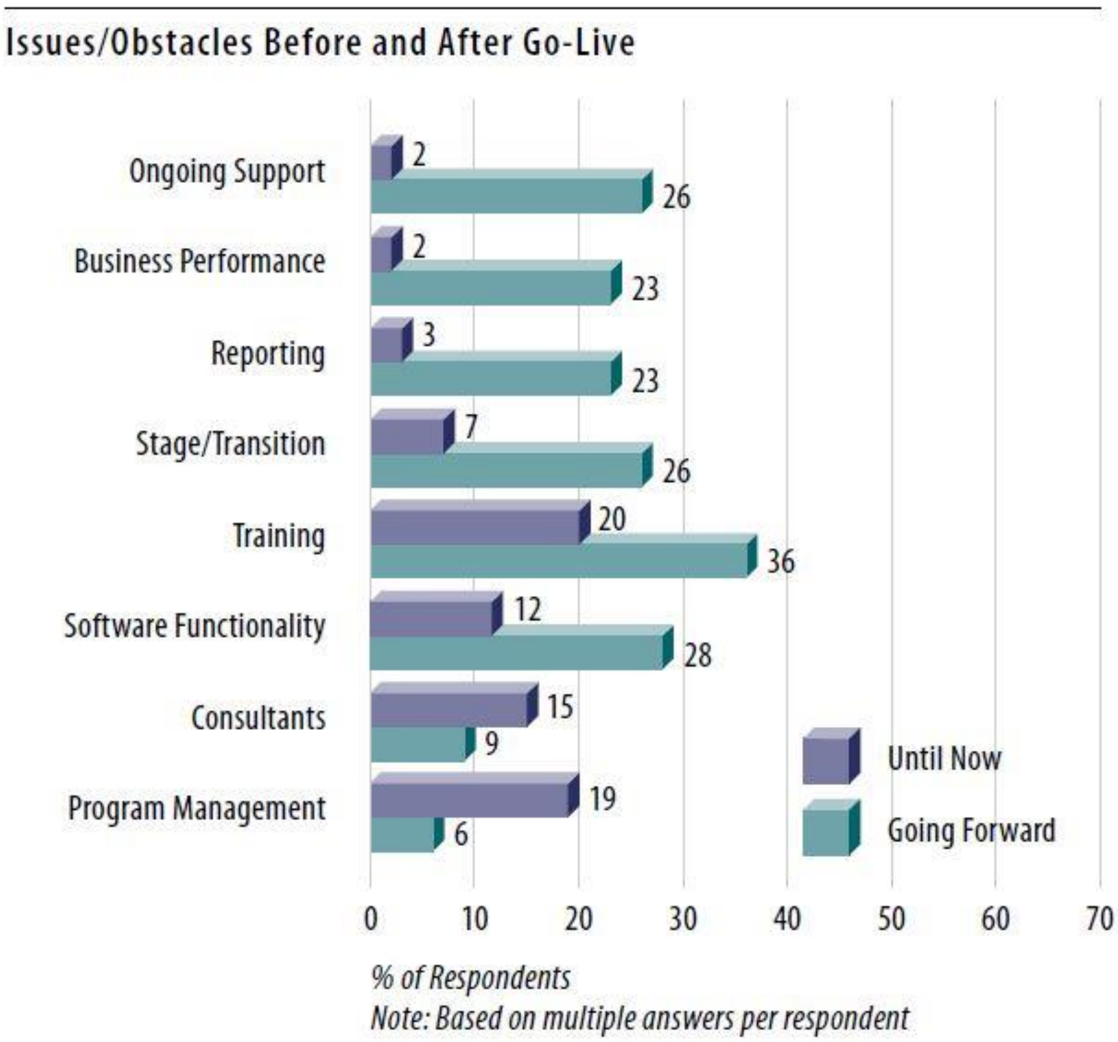
D10


Issues/Obstacles Until Going Live
Change Management
Internal Staff Adequacy
Project Team
Training
Prioritization/Resource Allocation
Top Management Support
Consultants
Ownership (of Benefits and Other)
Discipline
People 62%
Program Management
Process Reengineering
Stage/Transition
Benefit Realization
Process 16%
Software Functionality
Application Portfolio Management
Enhancements/Upgrades
Data
Reporting
Technology 12%
0
2
4
6
8
10
12
14
16
% of Mentions
Note: Based on multiple answers per respondent

D11

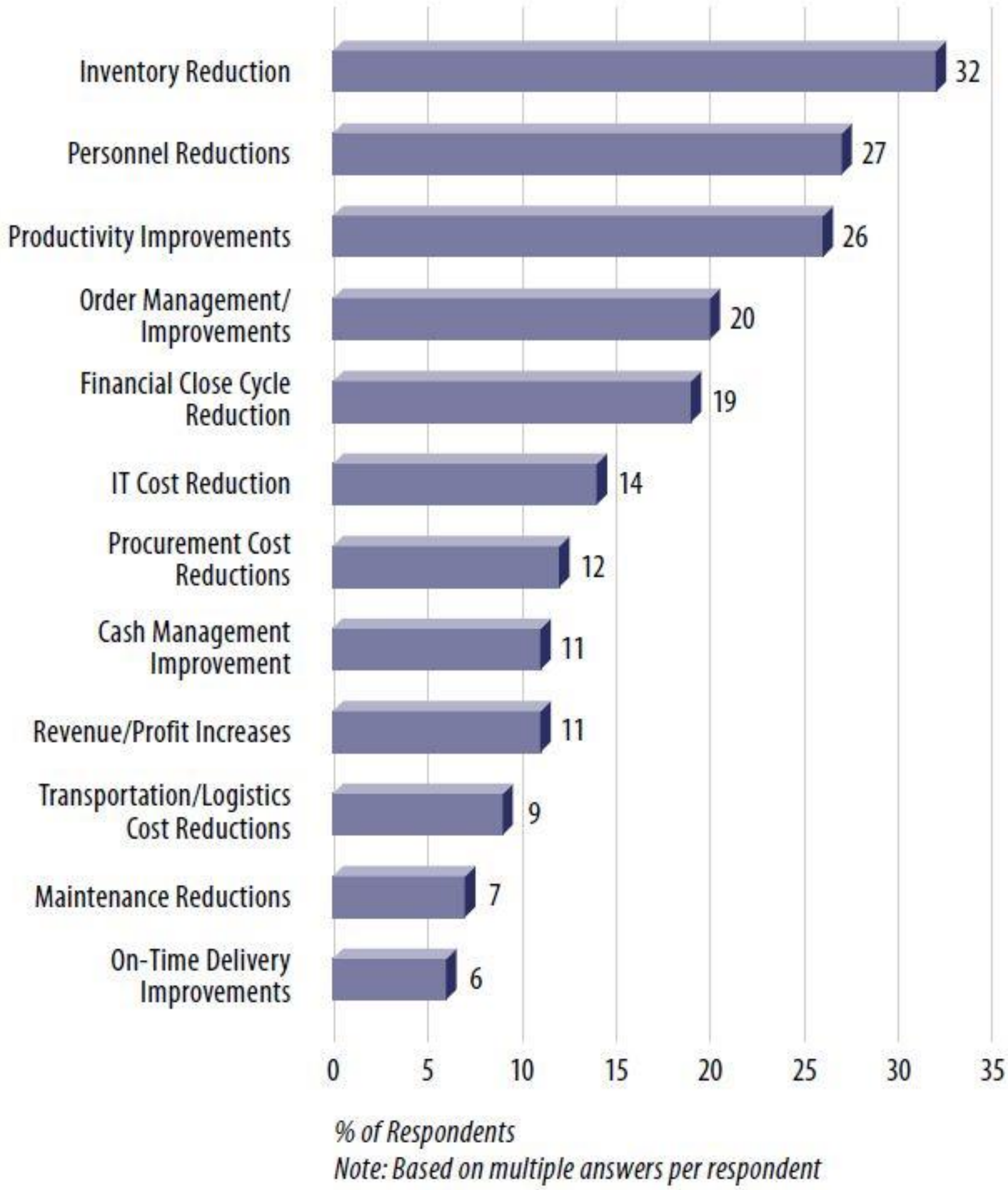

Issues/Obstacles Going Forward
Change Management
Training
Internal Staff Adequacy
Prioritization/ Resource Allocation
Project Team
Discipline
Ownership (of Benefits and Other)
People 51%
Ongoing Support
Stage/Transition
Business Performance
Process Reengineering
Process 19%
Software Functionality
Enhancements/Upgrades
Application Portfolio Management
Reporting
Technology 19%
0
2
4
6
8
10
12
14
16
% of Mentions
Note: Based on multiple answers per respondent

D12

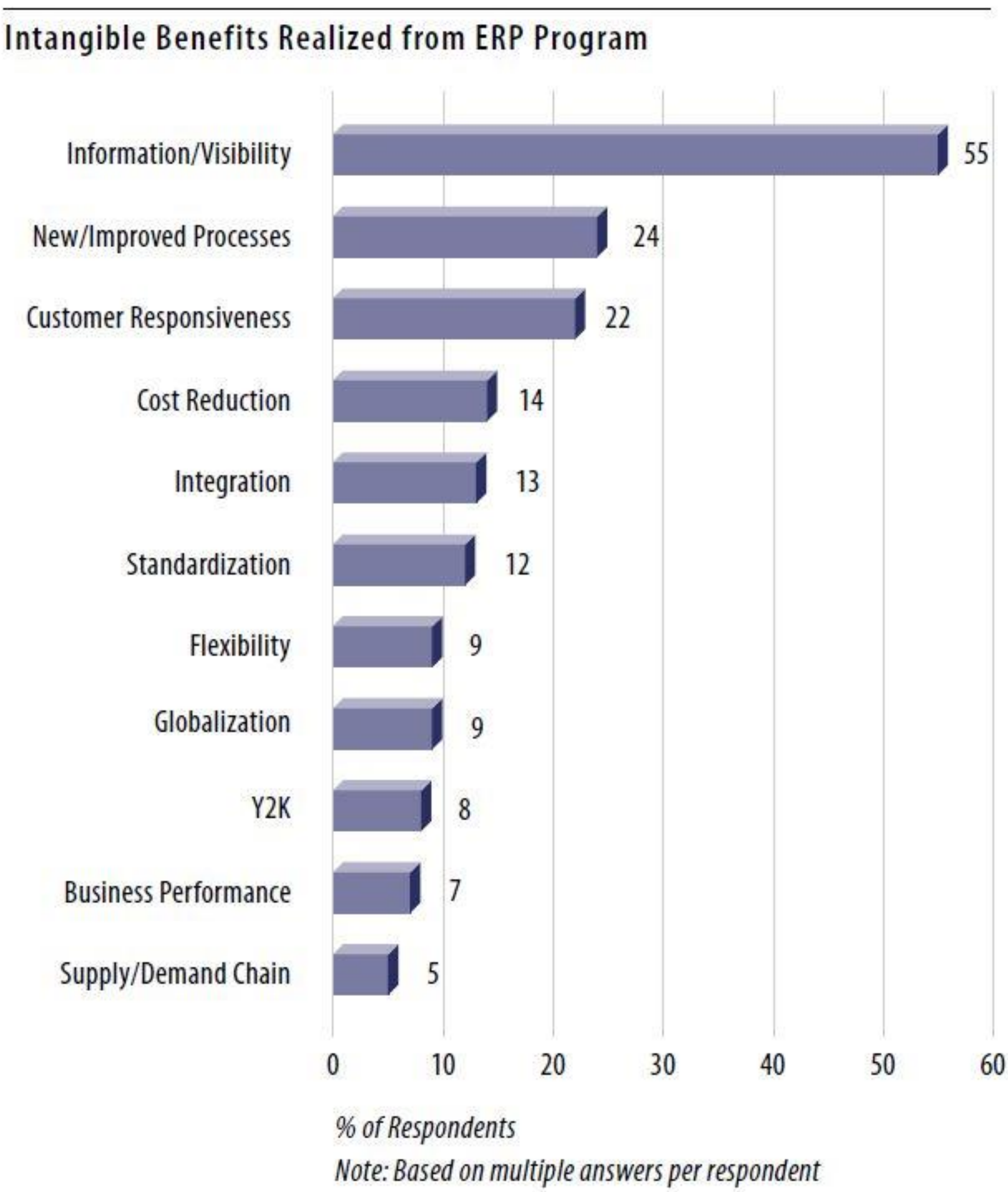

Issues/Obstacles Before and After Go-Live
Ongoing Support
Business Performance
Reporting
Stage/Transition
Training
Software Functionality
Consultants
Program Management
2
26
2
23
3
23
7
26
20
36
12
28
15
9
19
6
Until Now
Going Forward
0
10
20
30
40
50
60
70
% of Respondents
Note: Based on multiple answers per respondent

D13

Tangible Benefits Realized From ERP Program

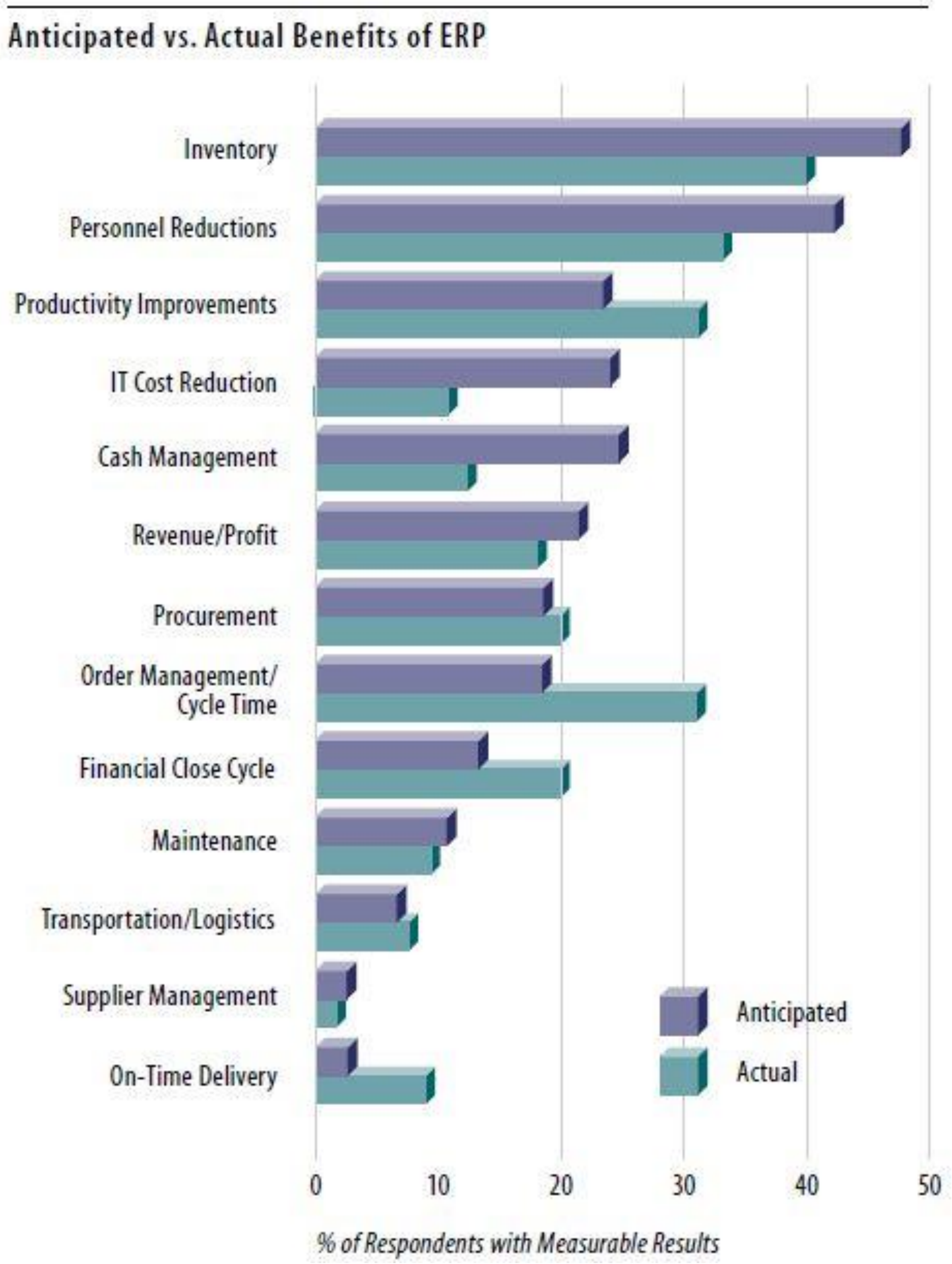


D14



Intangible Benefits Realized from ERP Program
Information/Visibility
55
New/Improved Processes
24
Customer Responsiveness
22
Cost Reduction
14
Integration
13
Standardization
12
Flexibility
9
Globalization
9
Y2K
8
Business Performance
7
Supply/Demand Chain
5
0
10
20
30
40
50
60
% of Respondents
Note: Based on multiple answers per respondent

D15


Anticipated vs. Actual Benefits of ERP
Inventory
Personnel Reductions
Productivity Improvements
IT Cost Reduction
Cash Management
Revenue/Profit
Procurement
Order Management/
Cycle Time
Financial Close Cycle
Maintenance
Transportation/Logistics
Supplier Management
On-Time Delivery
Anticipated
Actual
0
10
20
30
40
50
% of Respondents with Measurable Results

D16

Appendix Four

Critical success factors for ERP implementations in Belgian SME’s

Part I: Company parameters

1. Q: What is the position of the interviewee in the company? Indicate one answer.
   A: Board member; Logistics manager; Manufacturing; IT manager; Operations manager; Purchasing; Other.

2. Q: What is the yearly turnover of the company? Indicate one answer.
   A: Less than €2m; Between €2m and €10m; Between €10m and €50m; Between €50m and €100m; Larger than €2m.

3. Q: What is the number of employees in the company? Indicate one answer.
   A: Less than 10; Between 10 and 50; Between 50 and 250; Between 250 and 500; Larger than 500.

4. Q: What is the current situation of ERP in the company? Indicate one answer.
   A: The ERP system is installed; Installation is in progress; we plan to implement in the coming 18 months; No ERP is planned.

Part II: Pre-implementation activities

5. Q: What are the motivations to implement ERP? Evaluate each motivation on a scale from 1 (not important) to 5 (very important).
   A: To replace existing systems (scale of 1 to 5).
   To simplify and standardise the systems (scale of 1 to 5).
   To obtain a strategic advantage (scale of 1 to 5).
   To improve the interaction and communication with suppliers and customers (scale of 1 to 5).
   To ease the regular update of systems (scale of 1 to 5).
   To solve the year-2000 problem (scale of 1 to 5).
   To catch up with competitors (scale of 1 to 5)

6. Q: What was the strategic approach in the ERP implementation? Indicate one answer.
   A: One single ERP package; One single ERP package in combination with other systems; Several ERP packages in combination with other systems; A “best of breed” of several ERP packages; In-house development; In-house development, supplemented with specific package functionality.

7. Q: Has there been a formal internal evaluation of the ERP project before implementation? Indicate one answer.
   A: Yes; No.

8. Q: If a formal evaluation has been made, what evaluation methods were used? Indicate all methods used.
   A: Payback period; Return on investment; Net present value; Internal rate of return; Total cost of ownership; Other.

9. Q: If a formal evaluation has been made, what was the expected return on investment? Indicate one answer.
   A: Less than 5 per cent; Between 5 per cent and 15 per cent; Between 15 per cent and 25 per cent; Between 25 per cent and 50 per cent; Larger than 50 per cent.

Part III: Implementation experiences

10. Q: What was the planned duration of the project? Indicate one answer.
    A: Less than six months; Between six months and 12 months; Between 13 months and 18 months; Between 19 months and 24 months; Between 25 months and 36 months; Between 27 months and 48 months; larger than 48 months.

11. Q: What was the real duration of the project? Indicate one answer.
    A: Less than six months; Between six months and 12 months; Between 13 months and 18 months; Between 19 months and 24 months; Between 25 months and 36 months; Between 27 months and 48 months; larger than 48 months.

12. Q: What was the adopted implementation strategy? Indicate one answer.
    A: "Big Bang" (full implementation in one roll-out); Skeleton approach (first a limited version, adding functionality later); Single module approach (one module at a time); Phased approach per site (complete functionality per physical location).

13. Q: What was the total budgeted cost of the ERP implementation? Indicate one answer.
    A: Less than €0.5m; Between €0.5m and €1.5m; Between €1.5m and €5m; more than €5m.

14. Q: What was the total actual cost of the ERP implementation? Indicate one answer.
    A: Less than €0.5m; Between €0.5m and €1.5m; Between €1.5m and €5m; more than €5m.

15. Q: How is the actual cost spread over the following categories? Indicate a percentage for each category with a total of 100 per cent.
    A: Software (0-100 per cent); Hardware (0-100 per cent); Consultancy (0-100 per cent); Training (0-100 per cent); Implementation team (0-100 per cent); Other (0-100 per cent).

Part IV: ERP package and customisation

16. Q: What is the most important ERP package implemented? Indicate one answer.
    A: SAP; Oracle; Peoplesoft; Microsoft Dynamics; Baan (Invensys); IBS; IFS; Intentia; JD Edwards; Solid Data; Systemat Popsy; CCS; Aktiv; Briljant; TopPower; Other.

17. Q: How do you estimate the amount of required customisation? Indicate one answer.
    A: Large; Significant; Small; No customisation.

Part V: Implemented modules and level of customisation

18. Q: What ERP modules were implemented and what percentage of each implemented module was modified? Indicate all modules implemented and give a percentage for each implemented module.
    A: Purchasing (modified: 0-100 per cent); Order entry (modified: 0-100 per cent); Materials management (modified: 0-100 per cent); Production planning (modified: 0-100 per cent); Accounting (modified: 0-100 per cent); Distribution and logistics (modified: 0-100 per cent); Financial management (modified: 0-100 per cent); Asset management (modified: 0-100 per cent); Human resources (modified: 0-100 per cent); Quality management (modified: 0-100 per cent); Maintenance (modified: 0-100 per cent); Research and development (modified: 0-100 per cent).

19. Q: Which of the following extensions to the ERP system are being implemented (I), Planned (P), Considered (C) or not planned (N)? Indicate for each extension: I, P, C or N.
    A: Customer access to the ERP system (I, P, C or N).
    Data warehouse, business intelligence (I, P, C or N).
    E-business and e-commerce (I, P, C or N).
    Supplier access to the ERP system (I, P, C or N).
    Supply chain integration (I, P, C or N).
    CRM (I, P, C or N).
    Advanced planning tools (I, P, C or N).

Part VI: Benefits

20. Q: What were the benefits of the ERP implementation? Score each benefit from 1 (no benefit) to 5 (large benefit).
    A: Information is available faster (scale of 1 to 5).
    More interaction between employees (internally) (scale of 1 to 5).
    Better control over orders/Better order processing (scale of 1 to 5).
    Better financial management (scale of 1 to 5).
    Better customer intimacy (scale of 1 to 5).
    Fewer delays in deliveries (scale of 1 to 5).
    Better supplier intimacy (scale of 1 to 5).
    Less operational costs (scale of 1 to 5).
    Lower inventory (scale of 1 to 5).
    Better cash management (scale of 1 to 5)

21. Q: To what extent were benefits realised in the following domains? Score each domain from 1 (no benefit) to 5 (large benefit).
    A: Information availability (scale of 1 to 5).
    Business processes integration (scale of 1 to 5).
    Information quality (scale of 1 to 5).
    Inventory management (scale of 1 to 5).
    Financial management (scale of 1 to 5).

Flexibility towards customers (scale of 1 to 5)
Supplier management (scale of 1 to 5)
Human resources management (scale of 1 to 5)
IT cost improvement (scale of 1 to 5)

Part VII: Critical success factors: vision, scope and goals

22. Q: Which of the following aspects were thoroughly considered before the project and were followed-up during the project? For each aspect, indicate whether it was considered (C), Followed-up (F) or both (CF)
    A: A vision on the ERP project (C, F or CF)
    Strategic goals (C, F or CF)
    A new business model (C, F or CF)
    A business plan, spelling out the:
    benefits (C, F or CF);
    resources (C, F or CF);
    costs (C, F or CF);
    risks (C, F or CF);
    time line (C, F or CF).

23. Q: Was the project mission clearly articulated? Indicate one answer.
    A: Yes; No.

24. Was the project mission related to the business needs? Indicate one answer.
    A: Yes; No.

25. Q: How many modules (functionalities), business processes, users and sites were included in the project? For each, answer with one (1), a limited number (L) or All (A).
    A: Modules (1, L or A); Business processes (1, L or A), Users (1, L or A), Sites (1, L or A).

26. Q: How would you describe the level of the basic requirements? Indicate one answer.
    A: Low; Rather low; Average; Rather high; High.

27. Q: How were management query and reporting tools considered? Indicate one answer.
    A: They were part of the required ERP functionality; They were purchased from a third party; Neither.

Part VIII: Critical success factors: culture, communication and support

28. Q: Were the following groups informed about the project? Did they provide input? Did they actively participate in the implementation process? Did they have a facilitating role in the project? For each group, indicate whether they were not informed (1), informed but not actively participating (2), provided input (3), actively participated (4) or had an active facilitating role (5).
    A: Top management (1-5); Senior management (1-5); IT management (1-5); IT staff (1-5); Line management (1-5); Operational staff (1-5).

29. Q: Indicate which of these statements applies to top management during the ERP implementation process. For each statement, indicate whether it applies (Y) or not (N).
    A: Top management . . .
    approves the project (Y or N).
    . . . publicly supports the project and calls it a top priority (Y or N).
    . . . mediates in conflicts, arising in the project (Y or N).
    . . . actively engages and participates in the project (Y or N).
    . . . is concerned with the integration of the ERP project in the enterprise (Y or N).
    . . . understands ERP (Y or N).

30. Q: What changes in organisational structure and culture were communicated by the top management? Indicate all changes that apply.
    Guidelines for the introduction of the new system
    A shared vision on the organisation and the role of the new system
    New organisation goals
    New organisational structures, roles and responsibilities
    Other (please specify).

31. Q: What priority did the ERP project receive in comparison to other large IT projects in the domains of staffing, budget and time? For each factor, give a score of 1 (much less), 2 (less), 3 (equal amount), 4 (more) or 5 (much more).
    A: Personnel (1-5); Budget (1-5); Time (1-5).

32. Q: To what extent did the approved means suffice to implement the project? For each factor, give a score of 1 (much less), 2 (less), 3 (equal amount), 4 (more) or 5 (much more).
    A: Personnel (1-5); Budget (1-5); Time (1-5).

33. Q: How was the project budget determined? Indicate one answer.
    A: The budget was fixed before the project start; The budget was somewhat flexible, but a payback period was imposed; There was no budget control.

34. Q: Which of the following properties does your organisation have and was instrumental for the ERP project? Indicate all that apply.
    A: A culture with shared values and common goals; A culture of open communication;
    A strong corporate identity; A flexible organisation, open to change; An emphasis on quality; Strong IT capabilities; The will to accept new technologies; Perseverance with respect to implementation problems.

35. Q: Which measures were taken to improve the integration of ERP into the organisation? Indicate all that apply.
    A: User training; Regular communication; Use of “change agents”; Referral to the corporate culture; On-the-job user assistance; Conflict management; Other (please specify).

36. Q: What kind of information was solicited from the users before, during and after the project? Indicate all that apply.

A: Requirements (before); Remarks (during); Feedback (afterwards); Approval (throughout).

37. Q: What kind of user information was taken into account? Indicate with 1 (not taken into account) to 5 (fully taken into account).
A: Requirements (before); Remarks (during); Feedback (afterwards); Approval (throughout).

38. Q: What is the general level of acceptance of the ERP system by the users? Indicate one.
A: Very positive (enthusiasm); Positive (acceptance); Neutral; Negative (no acceptance); Very negative (resistance).

39. Q: When were the users informed about the following aspects of the ERP project? For each aspect, indicate B if users were informed before the start, D if they were informed during the project or A if they were informed after the project. Indicate N if users were not informed about this aspect.
A: The project existence (B, D, A or N)
The project importance (B, D, A or N)
The project scope (B, D, A or N)
The project goals (B, D, A or N)
The performance expectations (B, D, A or N)
The time frame (B, D, A or N)
The project activities (B, D, A or N)
Project updates (B, D, A or N)

40. Q: How is the relation with the ERP software supplier? Indicate one.
A: The ERP supplier is only the seller of the system; The supplier also provides implementation consultants; The supplier is a partner.

Part IX: Critical success factors: Infrastructure

41. Q: How would you qualify the IT infrastructure at the start of the ERP project? Indicate one answer.
A: Standardised; Rather standardised; Rather proprietary; Proprietary

42. Q: How complex would you call these aspects of your organisation before the ERP implementation? Score each aspect with 1 (simple), 2 (rather simple), 3 (average), 4 (rather complex) or 5 (complex).
A: Business processes (1-5); Organisational structure (1-5); IT (1-5).

43. Q: How varied would you call these aspects of your organisation before the ERP implementation? Score each aspect with 1 (simple), 2 (rather simple), 3 (average), 4 (rather complex) or 5 (complex).
A: Business processes; IT platforms; IT applications.

Part X: Critical success factors: General approach

44. Q: How was the implementation organised? Indicate one answer.

A: Phased approach per product line; Phased approach per location; Simultaneous introduction for all products and all locations.

45. Q: What was the major goal of the implementation? Indicate one answer.
A: Standardisation of processes over all locations; Local optimisation of processes.

46. Q: How important were these arguments in the choice of the ERP package? Score each argument from 1 (not important) to 5 (very important).
A: Vendor support (1-5); References (number of previous implementations of the package) (1-5); Functionality match (1-5).

47. Q: To what extent was there a match between the existing business processes and the business processes, supported by the chosen ERP package? Give a percentage.

48. Q: How was the gap between required and supported functionality closed? Indicate one answer.
A: The ERP system was adjusted to the business processes; The business processes were adjusted to the ERP system; Both were modified.

49. Q: To what extent was the ERP system modified? Indicate one answer.
A: No modification; Simple parameterisation, no or minimal code modifications; Complex parameterisation, no or minimal code modifications; Extensive code modifications.

50. Q: To what extent were business processes modified? Indicate one answer.
A: No modifications; Minor modifications; Business processes were redesigned (Business process re-engineering).

51. Q: If business processes were re-engineered, which ones of the following statements are true? Indicate all that apply.
A: Process modelling tools were used; The re-engineering was started before the onset of the ERP project; The re-engineering was iterative.

52. Q: Rank the following factors in order of emphasis during the project. Indicate the factor with the most emphasis as 1.
A: New technology; Business benefits; User requirements; Other (please specify).

53. Q: What percentage of the ERP implementation budget was allocated to user training? Give a percentage.

54. Q: What percentage of the user training was dedicated to the following subjects. Indicate a percentage for each subject, with a total of 100 per cent.
A: Technical knowledge of the ERP system with its reference models (0-100 per cent).
User technical training (how to use the software) (0-100 per cent).
User business training (how to support business processes) (0-100 per cent).
Other (please specify) (0-100 per cent).

55. Q: When were the users trained? Indicate one answer.
A: Long before the system was rolled-out; At system roll-out; After roll-out.

56. Q: Were external consultants used in the ERP implementation? Indicate one answer.
    A: Yes; No.

57. If consultants were used, for what purpose? Indicate all that apply.
    A: Expertise in cross-functional business processes; Expertise in system configuration;
    Expertise in application-specific modules; Knowledge transfer to internal IT staff; Other (please specify).

58. Q: What happens/happened to the existing systems, replaced by the ERP system, at ERP roll-out? Indicate one answer.
    A: Existing systems were made unavailable to the users; Existing systems are only available in case of emergency; Existing systems run in parallel with ERP systems.

59. Q: What measures were taken to ensure data accuracy in the new system? Indicate all answers that apply.
    A: None; Quality control before migration from the existing systems; User communication of the importance of data accuracy; Training on correct data entry during user training; Other (please specify).

Part XI: Critical success factors: Project planning & control

60. Q: Which of the following plans were defined before the onset of the project and were followed-up during the project? For each plan, indicate D for defined before the onset and F for followed-up during the project.
    A: Project plan (D, F); Project goals (D, F); Scope delimitation (D, F); Activity plan (D,F), Milestones (D, F); Resources plan (D, F); Follow-up plan (D, F); Continuity plan (D,F).

61. Q: Was the ERP project divided into smaller subprojects? Indicate one answer.
    A: Yes; No.

62. Q: If the project was divided into subprojects, did each of these subprojects have its own goals in terms of business benefits? Indicate one answer.
    A: Yes; No.

63. Q: What criteria were used to evaluate the project progress and performance? Indicate all that apply.
    A: Project management based criteria (e.g. milestones, delivery times, resource usage);
    B: Business-related performance criteria.

64. Q: Was user feedback taken into account during the project? Indicate one answer.
    A: Yes; No.

65. Q: How long after the roll-out will the performance of the ERP system be monitored? Indicate one answer.
    A: No monitoring; one month; six months; one year; two years; as long as the system is operational.

Part XII: Critical success factors: project team

66. Q: Give the composition of the project team. For each kind of participant, give a percentage, totalling 100 per cent.
    A: Technical IT experts (0-100 per cent); Business analysts (0-100 per cent); Users (0-100 per cent); External consultants (0-100 per cent); Other (please specify) (0-100 per cent)
    .
67. Q: Was the project team created specifically for this project? Indicate one answer.
    A: Yes; No.

68. Q: Are/were all team members full-time assigned to the project? Indicate one answer.
    A: Yes; No.

69. Q: How broad is the authority of the team? Indicate one answer.
    A: The team is authorised to take decisions autonomously, whereby management is informed; The team continuously communicates with the management, but is authorised to take urgent decisions; All important decisions are taken by the management.

70. Q: Does the project team receive special compensation for completion of the ERP project within time and within budget? Indicate one answer.
    A: Yes; No.

71. Q: Does the top management receive special compensation for completion of the ERP project within time and within budget? Indicate one answer.
    A: Yes; No.

72. Q: Does the project team receive special compensation if the ERP system performs according to or exceeding expectations? Indicate one answer.
    A: Yes; No.

73. Q: Does the top management receive special compensation if the ERP system perform according to or exceeding expectations? Indicate one answer.
    A: Yes; No.

74. Q: How important were the following criteria in the choice of a project manager? Score each criterion from 1 (not important) to 5 (very important).
    A: Skills (1-5); Experience (1-5); Reputation (1-5); Flexibility (1-5); Other (please specify) (1-5).

75. Q: Was a project champion appointed? Indicate one answer.
    A: Yes; No.

76. Q: What are the main characteristics of the project champion? Indicate all that apply.
    A: The project champion . . .
    . . . is part of the business;
    . . . is a top manager;
    . . . is a middle manager;

. . . is the internal promoter of the project;
. . . has a clear vision on the future;
. . . inspires others to share a common vision;
. . . emphasises the benefits of the project;
. . . defends the ERP system at all times;
. . . manages resistance to change;
. . . solves conflicts;
. . . keeps in touch with the users;
. . . supervises the use of the new system.

Appendix Five

PQM Matrix for each SAP Implementation Phase

1. SAP Phase 1 – Project Preparation.

2. SAP Phase 2 – Business Blueprint.

3. SAP Phase 3 – Realization.

4. SAP Phase 4 – Final Preparation.

5. SAP Phase 5 – Go Live & Support.

PQM matrix for each SAP implementation phase

1. SAP Phase 1 – Project Preparation

ASAP Phase 1	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Define project mission statement	1		1			1	1	1	1								1							7
Define business drivers	1		1		1		1	1																5
Identify business measurements	1		1		1		1	1																5
Identify project measurements	1		1			1	1	1			1													6
Develop change charter	1	1					1	1				1												5
Assemble project charter components		1						1				1												3
Approve project charter	1					1	1	1	1		1													6
Create and issue project charter																								11
Review implementation proposal	1		1				1	1				1					1				1	1		8
Confirm implementation proposal	1	1	1			1	1	1			1	1					1				1			10
Check strategy for corporate rollout		1						1			1						1						1	5
Review and refine implementation strategy																								12
Plan environment	1						1	1		1		1							1					6
Set up environment								1			1	1												3
Establish project team working environment																								7
Refine organization and roles				1				1	1						1									4
Assign people to roles				1				1		1		1			1									5
Assign people to core change roles	1	1		1			1																	4
Conduct project team transition meeting	1							1			1													3
Create the extended change team	1	1		1		1	1																	5
Determine project organization																								11

PQM matrix for each SAP implementation phase

ASAP Phase 1	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Create project work plan		1						1	1			1												4
Create project budget plan								1	1			1												3
Create project resource plan								1	1	1		1			1									5
Prepare project plan																								6
Review suggestions from pre-implementation			1					1					1											3
Refine training course plan	1							1				1	1											4
Register and schedule team training								1				1	1											3
Organizational change management training and team building		1											1											2
Create project team training plan																								6
W1.1. Initial project planning																								19
Identify project communication plan								1			1	1												3
Define project documentation								1	1			1												3
Create issue management plan	1							1			1	1		1										5
Create organizational change management plan	1	1			1		1				1	1												6
Create scope management plan	1		1			1	1	1			1	1												7
Create team building plan								1		1	1	1	1											5
Define project planning and monitoring plan								1				1												2
Define strategy for using R/3 services								1				1			1									3
Determine quality assurance standards	1						1	1				1			1									5
Define project management standards and procedures																								13
Project review preparation	1							1			1													3
Define system configuration standards								1										1		1				3
Define end user training and documentation strategies	1	1						1					1											4

PQM matrix for each SAP implementation phase

ASAP Phase 1	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Define testing strategies								1									1					1		3
Define post-implementation service and support strategy								1	1															2
Define system authorization standards for project team		1									1									1				3
Determine system problem and errors handling procedures	1						1	1																3
Define system enhancement and modification approvals		1						1							1			1	1					5
Define ABAP development standards															1									1
Define implementation standards and procedures																								14
Determine required systems								1							1		1		1	1				5
Determine client deployment strategy															1		1			1				3
Define release strategy								1				1							1					3
Define transport system strategy									1		1	1			1									4
Define system landscape strategy																								8
W1.2. Project procedures																								19
Prepare kickoff meeting								1			1	1												3
Conduct kickoff meeting	1					1	1	1			1													5
Company-wide project Introduction								1			1	1												3
Kickoff meeting																								6
prepare for standards meeting								1			1	1												3
conduct standards meeting								1		1	1													3
Project team standards meeting																								4
W1.3. Project kickoff																								7
Complete technical requirements questionnaire									1						1					1				3
Define technical infrastructure needs															1					1				2

PQM matrix for each SAP implementation phase

ASAP Phase 1	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Identify technical requirements																								3
Size initial hardware									1					1	1					1				4
Review system sizing results														1	1					1				3
Approve sizing results	1						1	1			1									1				5
Order initial hardware	1						1	1	1		1				1					1				7
Order remote network connection									1					1						1				3
Procure hardware																								8
W1.4. Technical requirements planning																								8
Conduct quality check								1																1
Sign off project preparation phase	1						1	1			1													4
Perform quality check and obtain approval																								4
W1.5. Quality check project preparation phase																								4
Project preparation Phase																								22
Total	24	12	8	4	3	7	19	47	13	5	22	26	6	4	15	0	7	2	4	11	2	2	1	
Sten	8	6	5	4	4	5	7	10	6	4	8	8	5	4	6	4	6	4	4	6	4	4	4	

PQM matrix for each SAP implementation phase

2. SAP Phase 2 – Business Blueprint

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Prepare project preparation review	1						1	1	1		1	1					1							7
Conduct project preparation review	1					1	1	1	1		1	1			1		1							9
Follow up on project preparation review recommendations	1						1		1		1	1					1							6
Project preparation review																								9
Prepare for status meeting	1							1			1	1												4
Attend status meetings								1		1	1													3
Follow-up on action items								1			1					1								3
Correct project variances								1				1												2
Refine project plan	1							1				1												3
Conduct project team status meetings																								6
Prepare for the steering committee meeting	1							1			1	1												4
Attend the steering committee meeting	1						1	1			1													4
Follow-up on action items								1			1					1								3
Conduct steering committee meetings																								5
Conduct team building activities	1						1	1		1	1	1												6
Define end user roles and responsibilities						1		1					1											3
General project management																								8

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
W2.1. Project management blueprint phase																								12
Develop perceived organizational impacts		1			1		1	1																4
Create a business impact map																								4
Develop a leadership risk assessment tool		1					1									1								3
Administer the leadership risk assessment tool		1				1	1																	3
Create leadership risk profile		1					1									1								3
Conduct leadership risk workshop		1				1	1				1													4
Integrate leadership risk assessment with sponsor-building process		1						1								1								3
Complete the baseline leadership risk assessment																								6
Implement senior sponsorship process	1	1				1	1				1													5
Implement key site sponsorship process	1	1				1	1	1			1					1								7
Develop sponsorship strategy																								7
Develop a project team risk assessment tool		1					1			1														3
Administer the project team risk assessment tool		1				1	1																	3
Create a project team risk profile		1		1			1			1														4
Conduct project team risk workshop		1				1				1	1													4
Implement action plan resulting from risk workshop		1								1		1												3
complete the baseline project team risk assessment																								7

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Identify the organizational context for the change project		1			1																			2
Create the organizational risk assessment plan		1			1	1						1												4
Develop the organizational risk assessment tool		1					1																	2
Conduct line manager engagement meetings		1				1					1													3
Administer the baseline organizational risk assessment tool		1				1					1	1												4
Create the baseline organizational risk profile		1			1	1																		3
Conduct organizational risk workshop(s)		1			1	1					1													4
Summarize results and debrief with key site sponsors		1									1													2
Create and provide feedback packages to line managers		1				1					1	1												4
Implement action plan resulting from organizational risk workshop(s)		1				1						1				1								4
Complete the baseline organizational risk assessment																								7
Identify point person to manage project communication		1		1			1				1													4
Develop foundation for project communications		1				1					1													3
Integrate risk assessment results into ongoing communications		1									1													2
Disseminate project-specific information across the organization		1				1					1	1												4
Establish change communication framework																								6
Establish the skills development team		1		1									1											3
Develop the organizational change management training strategy		1			1								1											3

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Select internal or external training delivery partners									1				1		1									3
Define processes for evaluating and managing training effectiveness													1		1									2
Establish management structure for skills development process																								5
Create the core knowledge transfer team		1		1																				2
Define the core knowledge transfer processes		1			1																			2
Establish management structure for knowledge transfer process																								3
W2.2. Organizational change management																								14
Refine training schedule								1				1	1											3
Prepare for training								1					1											2
Attend project team training										1			1											2
Review and assess post training skills		1		1				1					1											4
Conduct project team training																								6
W2.3. Project Team Training business Blueprint phase																								6
Document physical system(s) layout and distribution															1					1	1			3
Define and document printing infrastructure															1					1				2
Document network topology															1					1				2
Document interface topology															1					1	1			3
Define change request management											1													1

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Define release management strategy								1											1					2
Define desktop management strategy															1					1				2
Approve technical design								1																1
Create technical design																								6
Install Initial hardware															1					1				2
Verify initial systems technical environment														1	1					1		1		4
Install and configure development system															1					1				2
Install PC clients for project team members																				1				1
Create user master records for project team members																				1				1
Create operating system and database security for project team															1					1				2
Install and configure printing services for project team															1					1				2
Configure remote network connection															1					1				2
Set up remote connection to SAP																				1				1
Set up development environment																								3
Install and configure development system clients															1					1				2
Configure and test transport system																				1		1		2
Document the 'DEV-Clients' section of IT infrastructure document																				1				1
Set up initial system landscape																								3

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Conduct basis and system administration workshop											1				1					1				3
Define system administration for development system												1			1	1				1				4
Configure CCMS															1									1
Define backup strategy and configure SAPDBA															1					1				2
Verify system administration functions															1							1		2
Identify authorization objects for tasks										1		1			1									3
Define change request and transport process															1									1
Define release management strategy															1		1		1					3
Maintain System Administration Procedures																								9
Create enterprise IMG and maintain project header data															1									1
Generate project IMG and project IMG views															1									1
Initialize IMG																								1
W2.4. Develop system environment																								12
Schedule organizational structure workshop requirements								1				1												2
Distribute organization structure guidelines								1							1									2
Conduct organization structure workshop	1	1			1	1		1			1				1									7
Recommend and approve organization structure	1	1			1	1		1	1							1								7
Define Business organization structure																								10

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
W2.5. Business organization structure definition																								10
Schedule business process workshops						1		1				1												3
Conduct business process guideline workshop					1	1					1	1			1									5
Prepare for business process workshops																								6
Determine global parameters					1	1		1							1			1					1	6
Determine enterprise standards		1			1	1		1							1								1	6
Conduct general requirements workshops																								7
Determine business requirements		1			1	1									1			1						5
Determine the need for extended functions					1	1									1			1						4
Determine reporting requirements					1	1									1								1	4
Determine required interfaces						1									1					1	1			4
Determine conversion requirements						1								1	1						1		1	5
Determine require enhancements	1				1	1		1				1			1			1						7
Clarify deficient areas		1			1	1								1										4
Refine business requirement descriptions and models					1	1												1						3
Determine need for additional detailed workshops								1							1									2
Schedule detailed requirements workshops												1												1
Conduct business workshops																								11

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Determine detailed requirements					1	1		1							1			1						5
Refine business process definition and models		1			1										1			1						4
Conduct detailed requirements workshops																								6
Perform organizational optimization analysis		1		1	1	1																		4
Refine project organization and roles	1			1			1	1		1														5
Assemble business blueprint			1		1			1							1									4
Identify baseline scope			1		1	1		1																4
Verify business blueprint completeness	1				1	1																		3
Complete business blueprint																								10
Prepare for the business blueprint review					1							1												2
Conduct the business blueprint review	1				1	1	1	1																5
Business blueprint review and sign off																								6
Define end user training and documentation requirements												1	1											2
Develop prototype												1	1											2
Finalize end user training and documentation plan												1	1											2
Draft end user training and documentation plan																								2
W2.6. Business requirements definition																								19
Conduct quality check								1																1

PQM matrix for each SAP implementation phase

ASAP Phase 2	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Sign off business blueprint phase	1						1	1			1													4
Perform quality check and Obtain Approval																								4
W2.7. Quality check business blueprint phase																								4
Business Blueprint Phase																								19
total	17	39	2	7	26	36	20	36	5	9	28	26	12	3	40	9	4	7	2	21	4	3	4	
Sten	6	9	3	4	7	9	6	9	4	4	7	7	5	4	9	4	4	4	3	6	4	4	4	

PQM matrix for each SAP implementation phase

3. SAP Phase 3 – Realization

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Prepare Business blueprint review							1	1	1		1	1					1							6
Conduct business blueprint project review	1					1	1	1	1		1	1			1		1							9
Follow-up on business blueprint review recommendations	1						1		1		1	1					1							6
Business blueprint review																								9
Prepare for status meeting								1			1	1												3
Attend status meetings								1		1	1													3
Follow-up on action items								1			1													2
Correct project variances			1					1				1		1										4
Refine project plan			1					1				1												3
Conduct project team status meetings																								6
Prepare for steering committee meeting								1			1	1												3
Attend steering committee meeting	1						1	1			1													4
Follow up on action items								1			1			1										3
Conduct steering committee meetings																								6
Determine production support plan				1				1	1			1							1	1		1		7
Determine cutover plan								1				1										1		3
Initial planning for production support and cutover																								7

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Conduct team building activity				1				1		1	1	1												5
Project management																								5
Prepare project review							1	1				1												3
Conduct project review			1			1	1	1	1						1									6
Follow up on recommendations							1	1			1			1										4
Realization review																								10
W3.1 - Project management realization phase																								17
Define ongoing project team risk management process		1										1												2
Conduct periodic project team risk assessment(s) and workshop(s)		1									1													2
Document and analyze implementation risks over time		1																						1
Develop sustained project team risk management process																								3
Define organizational risk management process	1	1										1												3
Conduct periodic organizational risk assessment(s) and workshop(s)	1	1									1	1												4
Document and analyze implementation risks over time	1	1																						2
Create and provide feedback package(s) to line managers	1	1									1	1												4
Conduct risk management meetings with key constituencies		1									1													2
Deliver key project communications	1	1									1	1												4
Manage ongoing project sponsorship process	1	1																						2

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Manage ongoing skills development process		1		1									1											3
Maintain knowledge transfer team and process		1		1									1											3
Expand organizational change management training and team building		1		1									1											3
Develop sustained organizational risk management process																								6
W3.2 - Sustaining organizational change management processes																								6
Refine training schedule								1				1	1											3
Prepare for training													1											1
Review project team risk assessment results		1		1									1											3
Attend project team training										1			1											2
Review post training skills				1				1					1											3
Conduct project team training																								6
W3.3 - Project team training realization phase																								6
Refine baseline			1		1	1		1																4
create configuration plan for baseline					1							1						1						3
Determine test cases					1																	1		2
Create test plan for baseline						1						1										1		3
Assign resources				1				1														1		3
Approve plans for baseline configuration						1		1														1		3

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Refine project IMG								1																1
Develop plans for baseline configuration																								7
Establish general settings															1			1						2
Establish organizational structure															1			1						2
Incorporate predefined settings															1			1						2
Configure general settings and organizational structure																								2
Configure processes and functions						1									1			1						3
Migrate objects to QA environment																		1						1
Test baseline						1					1				1			1				1		5
Document and resolve issues						1												1				1		3
Refine business blueprint						1		1										1						3
Verify baseline configuration completion								1										1						2
Configure and validate baseline																								5
Prepare baseline scenarios															1							1		2
Develop baseline confirmation agenda						1		1				1										1		4
Prepare for baseline confirmation session								1			1	1						1				1		5
Prepare baseline confirmation																								7
Perform baseline scenarios						1																1		2

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Review and sign off baseline confirmation						1		1														1		3
Perform baseline confirmation																								3
W3.4 - Baseline configuration and confirmation																								10
Develop failure test plan												1		1	1					1		1		4
Develop volume test plan						1						1		1								1		4
Develop stress test plan												1		1								1		3
Develop system administration test plan												1		1	1							1		4
Develop printing and fax test plan												1		1	1					1		1		5
Develop system test plan																								6
Determine possible failure scenarios														1						1				2
Define disaster recovery procedures						1			1					1						1		1		5
Establish service level commitments									1					1						1				3
Define service level commitment																								5
Verify client copy utilities														1	1							1		3
Verify daily checks														1								1		2
Verify transport system														1								1		2
Verify backup and recovery procedures														1						1		1		3
Establish system administration functions																								4

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Install hardware															1					1				2
Verify systems technical environment														1	1					1		1		4
Install quality assurance system															1									1
Set up user master records															1									1
Secure quality assurance system																								0
Set up printing services															1					1				2
Set up client management and transport system																								0
Set up quality assurance environment																								4
Verify workload and data storage quantity estimates														1	1							1		3
Design production system disk layout															1					1				2
Define production system design																								4
Define production system security															1									1
Define production operating procedures															1					1				2
Define production system administration																				1				1
Define production system printing environment															1					1				2
Define production database administration procedures																				1				1
Create SAP system operation manual																				1				1
Define production system management																								2

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Install production hardware															1					1				2
Verify production system technical environment														1	1					1		1		4
Install production system															1					1				2
Install and configure network environment															1					1				2
Install desktop hardware and components															1					1				2
Secure operating system and database															1					1				2
Install printers and configure printing services															1					1				2
Set up production environment																								4
W3.5 - System management																								7
Refine final scope						1		1																2
Create configuration plan for final scope						1						1												2
Determine test cases						1																1		2
Create test plan for final scope						1						1		1								1		4
Assign resources												1										1		2
Schedule configuration workshops								1				1												2
Approve plans for final scope configuration						1		1								1						1		4
Develop plans for final scope configuration																								6
Conduct workshop (cycle 1 - n)						1					1													2

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Document business process decisions (cycle 1 - n)					1	1																		2
Document and resolve issues (cycle 1 - n)						1																		1
Conduct configuration workshops (cycle 1 - n)																								3
Configure processes and functions (cycle 1 - n)																		1						1
Migrate objects to QA environment (cycle 1 - n)																		1						1
Test final configuration (cycle 1 - n)						1												1				1		3
Verify final configuration completion								1										1						2
configure and validate final scope (cycle 1 - n)																								4
Prepare final confirmation scenarios						1												1						2
Develop final confirmation agenda												1												1
Prepare for final confirmation sessions												1												1
Prepare final confirmation																								3
Perform final confirmation scenarios						1												1				1		3
Review and sign off final confirmation						1		1										1				1		4
Perform final confirmation scenarios																								4
W3.6 - Final configuration and confirmation																								9
Create and register developers																								0
Create change requests																								0

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Prepare ABAP development project																								0
Define application hierarchy and development classes																								0
Create central repository objects																								0
Coordinate ABAP development																								0
W3.7 - Prepare and coordinate ABA development																								0
Create conversion detailed definition														1							1		1	3
Create conversion programs														1						1	1		1	4
Complete manual conversion procedures						1								1							1		1	4
Create conversion procedures																								4
Define conversion test procedures														1	1							1	1	4
Test and review conversion programs														1	1						1	1	1	5
Approve conversion test results															1							1	1	3
Migrate programs to the QA environment																						1		1
Test and migrate conversion programs																								7
W3.8 - Develop conversion programs																								7
Create interface detailed information						1	1	1												1	1		1	6
Develop online interface programs															1					1	1		1	4
Develop batch interfaces															1					1	1		1	4

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Create interface programs																								7
Define interface procedures						1														1			1	3
Test and review interface programs						1								1						1	1	1	1	6
Approve interface results						1														1			1	2
Migrate programs to QA environment																						1		1
Test and migrate interface programs																								4
W3.9 - Develop application interface programs																								8
Create enhancement detailed definition																								0
Check for approval						1		1																2
Create enhancements																								0
Develop enhancement procedures																								2
Define enhancement test procedures																								0
Test and review enhancement programs						1								1								1		3
Approve enhancement test results														1								1		2
Migrate enhancements to QA environment																						1		1
Test and migrate enhancement programs																								3
W3.10 - Develop Enhancements																								4
Create report detailed definition															1						1			2

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Check for approval	1					1	1	1																4
Develop reports															1					1				2
Create report procedures																								7
Define reports test procedures						1								1	1									3
Test and review reports														1	1							1		3
Approve reports for results						1									1	1						1		4
Migrate reports to QA environment																								0
Test reports																								5
W3.11 - Create reports																								10
Create form detailed definition															1					1				2
Check for approval	1					1	1								1					1				5
Develop forms															1	1				1				3
Create form procedures																								6
Define test procedures for forms						1									1	1								3
Test and review forms														1	1							1		3
Approve form test results						1									1	1						1		4
Migrate forms to QA environment																								0
Test forms																								5

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
W3.12 - Create forms																								8
review company security						1																		1
document transactions associated with job functions						1																		1
conduct authorization interview with data owners						1					1													2
identify information access and service use						1																		1
create authorization management procedures						1																		1
Create authorization detailed design																								2
Create activity groups						1																		1
Generate authorization profiles						1																		1
Create user master models for job roles																								0
Test user master models						1								1										2
Implement authorization concept																								2
Identify activity groups for users						1																		1
Create user masters						1									1									2
Validate user masters for job functions						1																		1
Refine authorization design						1																		1
Sign off authorization design						1										1								2
Validate authorization concept																								2

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
W3.13 - Establish authorization concept																								5
Design archive management strategy						1		1						1				1						4
Create archiving management																		1						1
Test archive procedures						1								1	1							1		4
Review archiving						1								1	1									3
Create archiving management																								6
W3.14 - Establish archiving management																								6
Define integration test scope						1		1						1								1		4
Define test cases								1						1								1		3
Create final integration test plan								1				1		1						1		1		5
Determine final integration test plan																								6
Verify migration of all objects to QA														1										1
Freeze system								1			1			1	1									4
Conduct final integration test						1		1						1								1		4
Finalize system								1						1	1							1		4
Review and finalize final integration test						1		1														1		3
Conduct final integration test																								6
W3.15 - Final integration test																								8

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Define end user documentation requirements		1				1		1																3
Write end user documentation development plan		1				1		1				1	1											5
Approve end user documentation development plan	1					1		1																3
Prepare end user documentation development plan																								6
Conduct end user documentation and training workshop								1			1		1											3
Create end user documentation								1																1
Create end user documentation																								3
Create end user training materials													1											1
Create end user training instructor guide													1											1
Develop end user training materials																								1
Organize training facility, equipment and logistics						1		1					1											3
Confirm end user enrollment						1		1					1											3
Prepare end user training																								3
W3.16 - End User documentation and training material																								7
Conduct quality check								1																1
Sign off realization phase	1						1	1			1													4
Conduct quality check and obtain approval																								4
W3.17 - Quality check realization phase																								4

PQM matrix for each SAP implementation phase

ASAP Phase 3	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructures and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Realization Phase																								
total	13	16	4	8	4	63	11	52	7	3	23	34	14	41	50	6	3	20	1	35	9	53	12	
Sten	5	5	4	4	4	10	4	9	4	4	6	7	5	8	9	4	4	5	3	7	4	9	5	

PQM matrix for each SAP implementation phase

4. SAP Phase 4 – Final Preparation

ASAP Phase 4	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate infrastructure and interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Prepare project review							1	1	1		1	1					1							6
Conduct project review	1					1	1	1	1		1	1			1		1							9
Follow-up on recommendations	1						1		1		1	1					1							6
Final preparation review																								9
Prepare for status meeting								1			1	1												3
Attend status meetings								1		1	1					1								4
Follow up on action items								1			1					1								3
Correct project variances			1					1				1												3
Refine project plan		1	1					1				1												4
Conduct project team status meetings																								7
Prepare for steering committee meeting								1			1	1												3
Attend steering committee meeting	1						1	1			1													4
Follow up on action items	1							1			1					1								4
Conduct steering committe meetings																								6
Continue organizational change management processes		1						1			1		1											4
Conduct team building activity		1						1		1	1	1	1											6
General project management																								6

PQM matrix for each SAP implementation phase

ASAP Phase 4	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate infrastructure and interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
W4.1 - Project management final preparation phase																								13
Finalize logistics for training						1		1					1											3
Initialize end user training environment						1		1					1											3
Load training data into end user training environment						1		1					1											3
Prepare for end user training																								3
Conduct end user training						1							1											2
Review end user training						1		1					1											3
Conduct end user training																								3
W4.2 - End user training																								3
Configure CCMS for production environment															1					1				2
Configure production printing and spool administration						1														1				2
Train system administration itself													1											1
Establish production system administration																								4
Conduct volume test						1								1	1					1		1		5
Conduct stress test						1								1	1					1		1		5
Conduct system administration tests														1								1		2
Conduct disaster recovery test														1	1					1		1		4
Conduct backup and restore procedure test														1						1		1		3

PQM matrix for each SAP implementation phase

ASAP Phase 4	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate infrastructure and interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Conduct printing and fax tests														1	1					1		1		4
Conduct going live check														1						1		1		3
Conduct technical system tests																								5
W4.3 -System management																								6
Review conversion timing and planning												1		1	1								1	4
Create conversion check list								1				1		1									1	4
Determine production readiness														1						1			1	3
Approval for cutover	1							1			1												1	4
Refine cutover																								8
Define help desk procedures						1		1			1													3
Create help desk facility								1					1											2
Reorganize team for productive support				1				1				1												3
Staff help desk								1		1			1											3
Define long-term production support strategy		1				1		1																3
Refine production support plan																								8
W4.4 - Detailed project planning																								13
Transport to production environment															1									1
Perform conversions						1								1									1	3

PQM matrix for each SAP implementation phase

ASAP Phase 4	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate infrastructure and interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Perform manual entries						1		1						1							1		1	5
Perform cut over to production system																								6
Approve the production system								1			1			1		1						1	1	6
Secure production environment														1						1				2
Verify end users are ready						1		1														1		3
Final approval for going live																								8
W4.5 – Cutover																								10
Conduct quality check								1																1
Sign off final preparation phase	1						1	1			1													4
W4.6 - Conduct quality check and obtain approval																								4
Final preparation phase																								20
Total	6	4	2	1	0	14	5	28	3	3	15	11	10	14	8	4	3	0	0	10	1	9	7	
Sten	5	5	4	4	3	8	5	12	4	4	8	7	6	8	6	5	4	3	3	6	4	6	6	

PQM matrix for each SAP implementation phase

5. SAP Phase 5 – Go Live & Support

ASAP Phase 5	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Prepare project review							1	1	1		1	1					1							6
Conduct project review	1					1	1	1	1		1	1			1		1							9
Follow-up on recommendations	1						1		1		1	1					1							6
Go Live &support Review																								9
Direct problems and issues								1			1			1										3
Manage and resolve problems						1		1		1	1	1		1										6
Provide production support																								6
Monitor daily and weekly transactions						1						1		1										3
Resolve issues								1		1	1			1										4
Confirm live environment	1							1																2
Validate live business process results																								6
W5.1. Production support																								11
Review and close open issues								1						1										2
Review business benefits	1	1	1		1		1	1			1													7
Summarize and review lessons learned from change process		1																						1
Complete organizational change management processes	1	1					1			1			1											5
Sign off and close issue list	1							1			1													3

PQM matrix for each SAP implementation phase

ASAP Phase 5	Sustained Management Support	Effective Organizational Change	Good Project Scope Management	Adequate Project Team Composition	Meaningful Business Process Redesign	User Involvement and Participation	Adequate project sponsor	Adequate project manager	Trust Between Partners	Dedicated Staff and Consultants	Strong Communication Inwards and Outwards	Formalize Project Plan/Schedule	Adequate Training Program	Preventive Trouble Shooting	Usage of Appropriate Consultants	Empower Decision Makers	Adequate ERP Implementation Strategy	Avoid Customization	Adequate ERP Version	Adequate Infrastructure and Interfaces	Adequate Legacy Systems Knowledge	Formalized testing plan	Adequate data migration process	Count
Project review																								10
W.5.2. Project end																								10
Go Live &support																								15
Total	6	3	1	0	1	3	5	9	3	3	8	5	1	5	1	0	3	0	0	0	0	0	0	
Sten	8	6	4	4	4	6	7	10	6	6	10	7	4	7	4	4	6	4	4	4	4	4	4	

References

AAKER, D. A. 1998. Developing business strategies, 1998.

ABADI, D. J. 2009. Data management in the cloud: Limitations and opportunities. *Bulletin of the IEEE Computer Society Technical Committee on Data Engineering,* 32**,** 3-12.

ABDINNOUR-HELM, S., LENGNICK-HALL, M. L. & LENGNICK-HALL, C. A. 2003. Pre-implementation attitudes and organizational readiness for implementing an enterprise resource planning system. *European Journal of Operational Research,* 146**,** 258-273.

ADAM, F. & O DOHERTY, P. 2001. Lessons from enterprise resource planning implementations in Ireland–towards smaller and shorter ERP projects. *Journal of Information Technology,* 15**,** 305-316.

ADOLPH, W. S. 1996. Cash cow in the tar pit: Reengineering a legacy system. *Software, IEEE,* 13**,** 41-47.

AGOSTINO, R. 2004. Business intelligence: solving the ERP overload",.

AGRAWAL, H., CHAFLE, G., GOYAL, S., MITTAL, S. & MUKHERJEA, S. 2008. An enhanced extract-transform-load system for migrating data in Telecom billing.

AKKERMANS, H. A., BOGERD, P., YUCESAN, E. & VAN WASSENHOVE, L. N. 2003. The impact of ERP on supply chain management: Exploratory findings from a European Delphi study. *European Journal of Operational Research,* 146**,** 284-301.

AL-MASHARI, M. 2000. Constructs of process change management in ERP context: A focus on SAP R/3.

AL-MASHARI, M. 2002. Implementing ERP through SAP R/3: A Process Change management (PCM) perspective. *King Saud University Journal—Computer & Information Sciences Division* 14, 25–37.

AL-MASHARI, M. & AL-MUDIMIGH, A. 2003. ERP implementation: lessons from a case study. *Information Technology & People,* 16**,** 21-33.

AL-MASHARI, M., AL-MUDIMIGH, A. & ZAIRI, M. Year. Realizing IT value: the case of enterprise resource planning. *In,* 2001.

AL-MASHARI, M., AL-MUDIMIGH, A. & ZAIRI, M. 2003. Enterprise resource planning: a taxonomy of critical factors. *European Journal of Operational Research,* 146**,** 352-364.

AL-MASHARI, M. & ZAIRI, M. Year. Standardization through SAP R/3; A proposed model for effective implementation. *In*, 1999.

AL-MASHARI, M. & ZAIRI, M. 2000a. Information and business process equality: the case of SAP R/3 implementation. *The Electronic Journal of Information Systems in Developing Countries,* 2.

AL-MASHARI, M. & ZAIRI, M. 2000b. Supply-chain re-engineering using enterprise resource planning (ERP) systems: an analysis of a SAP R/3 implementation case. *International Journal of Physical Distribution & Logistics Management,* 30**,** 296-313.

ALADWANI, A. Year. Coping with users resistance to new technology implementation: an interdisciplinary perspective. *In,* 1998. 54-9.

ALADWANI, A. M. 1999. Implications of some of the recent improvement philosophies for the management of the information systems organization. *Industrial Management & Data Systems,* 99**,** 33-39.

ALADWANI, A. M. 2001. Change management strategies for successful ERP implementation. *Business Process Management Journal,* 7**,** 266-275.

ALBA, J., LYNCH, J., WEITZ, B., JANISZEWSKI, C., LUTZ, R., SAWYER, A. & WOOD, S. 1997. Interactive home shopping: consumer, retailer, and manufacturer incentives to participate in electronic marketplaces. *The Journal of Marketing***,** 38-53.

ALDRIDGE, A., FORCHT, K. & PIERSON, J. 1997. Get linked or get lost: marketing strategy for the Internet. *Internet Research,* 7**,** 161-169.

ALLIO, R. P. & ALLIO, M. K. 1994. Benchmarking: a management tool for performance improvement. *Water Engineering & Management,* 141**,** 16-21.

AMBE, I. M. & BADENHORST-WEISS, J. A. 2011. Framework for choosing supply chain strategies. *African Journal of Business Management,* 5**,** 13388-13397.

AMOAKO-GYAMPAH, K. Year. User involvement, ease of use, perceived usefulness and behavioral intention: a test of the enhanced TAM in ERP implementation environment. *In*, 1999. 23.

ANCKAR, B. 2003. Drivers and inhibitors to E-commerce adoption: Exploring the rationality of consumer behaviour in the electronic marketplace. *Proceedings of the 11th ECIS on New Paradigms in Organizations, Markets and Society (Ciborra, C. et al. Ed.), Napoli, Italy*.

ANCKAR, B. & WALDEN, P. 2001. Self-booking of high-and low-complexity travel products: exploratory findings. *Information Technology &# 38; Tourism, 4,* 3**,** 151-165.

ANDERSON, C. & WOLFF, M. 2010. The Web is dead. Long live the Internet. *Wired Magazine,* 17.

APPERLRATH, H. & RITTER, J. 2000. SAP R/3 Implementation: Method and Tools. Springer, Berlin.

ARGYRIS, C. & SCHÖN, D. A. 1978. *Organizational learning: A theory of action perspective,* Addison-Wesley Reading, MA.

ARTHUR, W. B. 2009. *The nature of technology: What it is and how it evolves,* Free Press.

AUDRETSCH, D. B. 2001. Research issues relating to structure, competition, and performance of small technology-based firms. *Small Business Economics,* 16**,** 37-51.

AUDRETSCH, D. B. & MATA, J. 1995. The post-entry performance of firms: Introduction. *International Journal of Industrial Organization,* 13**,** 413-419.

AVITAL, M. & VANDENBOSCH, B. 2001. SAP implementation at Metalica: an organizational drama in two acts. *Journal of Information Technology,* 15**,** 183-194.

AZVINE, B., CUI, Z. & NAUCK, D. 2005. Towards real-time business intelligence. *BT Technology Journal,* 23**,** 214-225.

BAJWA, D. S., GARCIA, J. E. & MOONEY, T. 2004. An integrative framework for the assimilation of enterprise resource planning systems: phases, antecedents, and outcomes. *Journal of Computer Information Systems,* 44**,** 81-90.

BAKOS, Y. 1998. The emerging role of electronic marketplaces on the Internet. *Communications of the ACM,* 41**,** 35-42.

BĂLĂCEANU, D. 2007. Components of a Business Intelligence software solution. *Informatica,* 11.

BALSMEIER, P. & NAGAR, S. 2002. Implementing ERP in India–issues and problems. *Journal of Transnational Management Development,* 7**,** 3-12.

BANCROFT, N. H. 1996. Implementing SAP R/3: How to introduce a large system into a large organization.

BARUA, A., KONANA, P., WHINSTON, A. & YIN, F. 2000. Making e-business pay: Eight key drivers for operational success. *IT professional,* 2**,** 22-30.

BEARD, J. W. & SUMNER, M. 2004. Seeking strategic advantage in the post-net era: viewing ERP systems from the resource-based perspective. *The Journal of Strategic Information Systems,* 13**,** 129-150.

BÉDARD, Y., LARRIVÉE, S., PROULX, M., CARON, P. & LÉTOURNEAU, F. 1997. Geospatial Data Warehousing: positionnement technologique et stratégique. *Rapport pour le Centre de recherche pour la défense de Valcartier (CRDV).*

BÉDARD, Y., MERRETT, T. & HAN, J. 2001. 3 Fundamentals of spatial data warehousing for geographic knowledge discovery. *Geographic data mining and knowledge discovery*, 53.

BÉDARD, Y., PROULX, M. J., RIVEST, S. & BADARD, T. 2006. Merging hypermedia GIS with spatial on-line analytical processing: towards hypermedia solap. *Geographic Hypermedia*, 167-187.

BELLMAN, L. M. 2001. Bricks and mortar: 21st century survival. *Business Horizons,* 44**,** 21-28.

BENDOLY, E. & KAEFER, F. 2004. Business technology complementarities: impacts of the presence and strategic timing of ERP on B2B e-commerce technology efficiencies. *Omega,* 32**,** 395-405.

BENJAMIN, R. I. & WIGAND, R. 1995. Electronic markets and virtual value chains on the information superhighway. *Sloan Management Review,* 36**,** 62-72.

BERGSTROM, M. & STEHN, L. 2005. Matching industrialised timber frame housing needs and enterprise resource planning: a change process. *International Journal of Production Economics,* 97**,** 172-184.

BERNROIDER, E. & KOCH, S. 2001. ERP selection process in midsize and large organizations. *Business Process Management Journal,* 7**,** 251-257.

BERNROIDER, E. W. 2008. IT governance for enterprise resource planning supported by the DeLone–McLean model of information systems success. *Information & Management,* 45**,** 257-269.

BERSON, A. & SMITH, S. J. 2002. *Building data mining applications for CRM,* McGraw-Hill, Inc.

BHATT, G. D. 2000. An empirical examination of the effects of information systems integration on business process improvement. *International Journal of Operations & Production Management,* 20**,** 1331-1359.

BHATT, G. D. & EMDAD, A. F. 2001. An analysis of the virtual value chain in electronic commerce. *Logistics Information Management,* 14**,** 78-85.

BICKNELL, D. 1998. SAP to fight drug firm’s $500 M. suit over R/3 collapse. *Computer Weekly,* 3**,** 3.

BINGI, P., SHARMA, M. K. & GODLA, J. K. 1999. Critical issues affecting an ERP implementation. *Information systems management,* 16**,** 7-14.

BLATTBERG, R. C. & NESLIN, S. A. 1990. *Sales promotion: Concepts, methods, and strategies,* Prentice Hall Englewood Cliffs, NJ.

BLOCKER, M. 2005. E-learning: an organizational necessity, White Paper.

BOGATIN, D. 2010. Google CEO's new paradigm:'cloud computing and advertising go hand-in-hand'. ZDNet.

BONTEMPO, C. & ZAGELOW, G. 1998. The IBM data warehouse architecture. *Communications of the ACM,* 41**,** 38-48.

BORGATTI, S. P. & CROSS, R. 2003. A relational view of information seeking and learning in social networks. *Management science***,** 432-445.

BOTTA-GENOULAZ, V., MILLET, P. A. & GRABOT, B. 2005. A survey on the recent research literature on ERP systems. *Computers in Industry,* 56**,** 510-522.

BOUDREAU, M. C. & ROBEY, D. Year. Organizational transition to enterprise resource planning systems: theoretical choices for process research. *In,* 1999. Association for Information Systems, 291-299.

BOWER, J. L. & CHRISTENSEN, C. M. 1995. Disruptive technologies: catching the wave. *Harvard business review,* 73**,** 43.

BRAC 2009. The BI Survey 8: The World's Largest BI Survey by Nigel Pendse', www.bi-survey.com, accessed February 2012, Business Application Research Center (BRAC)

BRADLEY, P., GEHRKE, J., RAMAKRISHNAN, R. & SRIKANT, R. 2002. Scaling mining algorithms to large databases. *Communications of the ACM,* 45**,** 38-43.

BRAITHWAITE, T. 1994. *Information service excellence through TQM: Building partnerships for business process reengineering and continuous improvement*, ASQ Quality Press.

BREWS, P. & PUROHIT, D. 2007. Strategic planning in unstable environments. *Long Range Planning,* 40**,** 64-83.

BROWN, B., CHUI, M. & MANYIKA, J. 2011. Are you ready for the era of 'big data'? *McKinsey Quarterly,* 4**,** 24-35.

BROWN, C. V., VESSEY, I. & POWELL, A. 2000. The ERP purchase decision: Influential business and IT factors. *AMCIS 2000 Proceedings***,** 438.

BROWN, K. 2000. The Interactive Marketplace: Business-to-Business Strategies for Delivering Justin-Time, Mass-Customized Products. McGraw-Hill, Martinsburg, USA.

BRUECK, T., RIDDLE, R. & PARALEZ, L. 2003. Consortium Benchmarking Methodology Guide. *Denver: Awwa Research Foundation*.

BRYNJOLFSSON, E. & BROWN, P. 2005. VII pillars of productivity. *Optimize,* 4**,** 26-35.

BRYNJOLFSSON, E. & HITT, L. 1995. Information technology as a factor of production: The role of differences among firms. *Economics of Innovation and New technology,* 3**,** 183-200.

BRYNJOLFSSON, E. & HITT, L. 1996. Paradox lost? Firm-level evidence on the returns to information systems spending. *Management science***,** 541-558.

BRYNJOLFSSON, E. & HITT, L. M. 2000. Beyond computation: Information technology, organizational transformation and business performance. *The Journal of Economic Perspectives,* 14**,** 23-48.

BRYNJOLFSSON, E. & SMITH, M. D. 2000. Frictionless commerce? A comparison of Internet and conventional retailers. *Management science***,** 563-585.

BURKE, A. E. & TO, T. 2001. Can reduced entry barriers worsen market performance? A model of employee entry. *International Journal of Industrial Organization,* 19**,** 695-704.

BURKE, R. R. 2010. The third wave of marketing intelligence. *Retailing in the 21st Century***,** 159-171.

BURN, J. & ASH, C. 2005. A dynamic model of e-business strategies for ERP enabled organisations. *Industrial Management & Data Systems,* 105**,** 1084-1095.

BUSINESS DICTIONARY 2009. Business Dictionary Web site. http://www.businessdictionary.com/definition/business-drivers.html, accessed February 2012.

BUTLER, B. S. & GRAY, P. H. 2006. Reliability, mindfulness, and information systems. *MIS quarterly,* 30**,** 211-224.

BUYYA, R., YEO, C. S., VENUGOPAL, S., BROBERG, J. & BRANDIC, I. 2009. Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility. *Future Generation computer systems,* 25**,** 599-616.

BUZZELL, R. D. & GALE, B. T. 1987. *The PIMS principles: Linking strategy to performance*, Free Pr.

CALDAS, M. & WOOD, T. 1999. How consultants can help organizations survive the ERP frenzy. *Paper submitted to the Managerial Consultation Division of the Academy of Management, Chicago*.

CALISIR, F. 2004. The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with enterprise resource planning (ERP) systems. *Computers in Human Behavior,* 20**,** 505-515.

CAMP, R. 1989. *Benchmarking: The search for industry best practices that lead to superior performance*, Quality press Milwaukee.

CARR, D. K. & JOHANSSON, H. J. 1995. *Best practices in reengineering: what works and what doesn't in the reengineering process*, McGraw-Hill.

CARR, N. G. 2003. IT doesn't matter. *Educause Review,* 38**,** 24-38.

CARR, N. G. 2004. *Does IT matter?*, Harvard Business School Press.

CARTER, G. 2008. *The True Value of Business Architecture* [Online]. Available: http://www.information-management.com/issues/2007_53/10002083-1.html [Accessed October 10 2013 2013].

CEARLEY, D. W., FENN, J. & PLUMMER, D. C. 2010. Gartner's positions on the five hottest IT topics and trends in 2010. *Gartner Web Site*.

CHAFFEY, D. & SMITH, P. R. 2008. *eMarketing eXcellence: planning and optimizing your digital marketing*, Butterworth-Heinemann.

CHAN, R. 1999. Knowledge management for implementing ERP in SMEs. *3rd Annual SAP Asia Pacific SAPPHIRE*.

CHANG, H. H. & HUANG, W. C. 2006. Application of a quantification SWOT analytical method. *Mathematical and computer modelling,* 43**,** 158-169.

CHANG, M.-K., CHEUNG, W., CHENG, C.-H. & YEUNG, J. H. 2008. Understanding ERP system adoption from the user's perspective. *International Journal of Production Economics,* 113**,** 928-942.

CHANG, S. I., GABLE, G., SMYTHE, E. & TIMBRELL, G. Year. A Delphi examination of public sector ERP implementation issues. *In*, 2000. Association for Information Systems, 494-500.

CHARLAND, A. & LEROUX, B. 2011. Mobile application development: web vs. native. *Communications of the ACM,* 54**,** 49-53.

CHAUDHURI, S. & DAYAL, U. 1997. An overview of data warehousing and OLAP technology. *ACM Sigmod record,* 26**,** 65-74.

CHEE, T., CHAN, L., CHUAH, M., TAN, C., WONG, S. & YEOH, W. 2010. BUSINESS INTELLIGENCE SYSTEMS: STATE-OF-THE-ART REVIEW AND CONTEMPORARY APPLICATIONS.

CHEN, E. 2002. The 2003 IT Budget Pinch: Belts Get Pulled Even Tighter', eWeek, viewed 8 May 2003.

CHEN, H., CHIANG, R. H. & STOREY, V. C. 2012. Business Intelligence and Analytics: From Big Data to Big Impact. *MIS quarterly,* 36**,** 1165-1188.

CHEN, I. J. 2001. Planning for ERP systems: analysis and future trend. *Business Process Management Journal,* 7**,** 374-386.

CHEN, J. M. & CHEN, L. T. 2005. Pricing and production lot-size/scheduling with finite capacity for a deteriorating item over a finite horizon. *Computers & operations research,* 32**,** 2801-2819.

CHEW, W. B., LEONARD-BARTON, D. & BOHN, R. E. 1991. Beating Murphy's law. *Sloan Management Review,* 32**,** 5-16.

CHILDE, S., MAULL, R. & BENNETT, J. 1994. Frameworks for understanding business process re-engineering. *International Journal of Operations & Production Management,* 14**,** 22-34.

CHILDE, S., SMART, P. & WEAVER, A. Year. The use of generic process models for process transformation. *In*, 1997. Citeseer, 51-60.

CHIPLUNKAR, C., DESHMUKH, S. & CHATTOPADHYAY, R. 2003. Application of principles of event related open systems to business process reengineering* 1. *Computers & industrial engineering,* 45**,** 347-374.

CHOO, K. 1992. Strategic Management in Local Government Guiding principles for effective practice. *Local Government Policy Making,* 19**,** 42-42.

CHOO, K. K. R. 2010. Cloud computing: challenges and future directions. *Trends & issues in crime and criminal justice***,** 381-400.

CHOPRA, S. & MEINDL, P. 2007. Supply chain management. Strategy, planning & operation. *Das Summa Summarum des Management***,** 265-275.

CHOUDHARY, V. 2007. Comparison of software quality under perpetual licensing and software as a service. *Journal of management information systems,* 24**,** 141-165.

CHRISTENSEN, C. M., DONOVAN, T. & RESEARCH, H. U. G. S. O. B. A. D. O. 1998. The process of strategy development and implementation. HBS No.: 00-075, Working paper, Harvard Business School, Boston, MA, April.

CHUI, M., LÖFFLER, M. & ROBERTS, R. 2010. The internet of things. *McKinsey Quarterly,* 2**,** 1-9.

CHUNG, S. H. & SNYDER, C. A. 2000. ERP adoption: a technological evolution approach. *International Journal of Agile Management Systems,* 2**,** 24-32.

CLARK, R. 1997. Looking after business: linking existing customers to profitability. *Managing service quality,* 7**,** 146-149.

CLARK, T. J. 1999. *Success through quality: support guide for the journey to continuous improvement*, American Society for Qualit.

CLIFFE, S. 1999. ERP implementation. *Harvard business review,* 77**,** 16-17.

CODD, E. F., CODD, S. B., SALLEY, C. T., CODD & DATE, I. 1993. *Providing OLAP (on-line analytical processing) to user-analysts: An IT mandate*, Codd & Date, Inc.

CODY, W. F., KREULEN, J. T., KRISHNA, V. & SPANGLER, W. S. 2002. The integration of business intelligence and knowledge management. *IBM Systems Journal,* 41**,** 697-713.

COFFEY, M., KELLY, L. & PARKE, M. 2001. Enterprise resource planning (ERP).

COLLIS, D. & MONTGOMERY, C. 1995. Competing on resources. How do you create and sustain a profitable strategy. *Harvard business review,* 73**,** 118-128.

COOKE, D. P., PETERSON, W. J., BOARD, C. & CANADA, C. B. D. Year. SAP implementation: Strategies and results. *In*, 1998. Conference Board.

COOKE, J. 1998. Into the great wide open. *Logistics Management and Distribution Report,* 37**,** 84-7.

CORTES, C. & PREGIBON, D. 1997. Mega-monitoring. *unpublished paper presented at the University of Washington/Microsoft Summer Research Institute on Data Mining*.

COX, J. F., BLACKSTONE, J. H. & SPENCER, M. S. Year. APICS dictionary. *In*, 1992. American Production and Inventory Control Society.

COY, P. 2005. Why Logic Often Takes a Backseat. *Business Week*, 28.

CRAIG, R. S., VIVONA, J. A. & BERKOVITCH, D. 1999. *Microsoft Data Warehousing: Building Distributed Decision Support Systems*, John Wiley and Sons.

CROSS, R., PARKER, A., PRUSAK, L. & BORGATTI, S. P. 2004. 5. Knowing What We Know: Supporting Knowledge Creation and Sharing in Social Networks. *Creating value with knowledge*, 1**,** 61-82.

CROWLEY, R. 2002. Blueprint for an Enterprise E-learning Architecture. *Customer Interaction Solutions*, 21**,** 58-61.

CUI, Z., DAMIANI, E. & LEIDA, M. Year. Benefits of ontologies in real time data access. *In*, 2007. IEEE, 392-397.

CUKIER, K. 2010. *Data, data everywhere: A special report on managing information*, Economist Newspaper.

CUTLACK, G. 2013. *What are apps and how do they work with your smartphone?* [Online]. Available: http://www.techradar.com/news/phone-and-communications/mobile-phones/what-are-apps-and-how-do-they-work-with-your-smartphone--1141429 [Accessed 12 October 2013].

DANEVA, M. Year. Lessons learnt from five years of experience in ERP requirements engineering. *In*, 2003. IEEE, 45-54.

DANEVA, M. 2004. ERP requirements engineering practice: lessons learned. *IEEE software***,** 26-33.

DATE, C. 2003. *An Introduction to Database Systems 8 edition*, Addison-Wesley, Reading, MA 8 edition (22 July 2003).

DAVENPORT, T. 1998a. Serving Up ERP Value: Think Tank Instead of a warehouse or mart, the best place to get ERP data is a" data deli," where customized information comes with a side order of assistance. *CIO-FRAMINGHAM MA-*, 11**,** 26-29.

DAVENPORT, T. H. 1993. *Process innovation: reengineering work through information technology*, Harvard Business Press.

DAVENPORT, T. H. 1998b. Living with ERP. *CIO magazine*, 1**,** 12.

DAVENPORT, T. H. 1998c. Putting the enterprise into the enterprise system. *Harvard business review*, 76.

DAVENPORT, T. H. & BROOKS, J. D. 2004. Enterprise systems and the supply chain. *Journal of Enterprise Information Management*, 17**,** 8-19.

DAVID, F. R. 2011a. Strategic management: Concepts and cases. *Journal Entry,* 5**,** 2.

DAVID, F. R. 2011b. *Strategic management: Concepts and cases*.

DAVID, M. E. & DAVID, F. R. 2009. The Quantitative Strategic Planning Matrix (QSPM) applied to a retail computer store. *The Coastal Business Journal,* 8**,** 42-52.

DAVIS, B. & WILDER, C. 1998. False starts, strong finishes—companies are saving troubled IT projects by admitting their mistakes, stepping back, scaling back, and moving on. *Information Week,* 30**,** 41.

DE-KARE, M. 2000. E Shock 2000: the electronic shopping revolution: strategies for retailers & manufacturers.

DE SOUSA, J. M. E. 2004. *Definition and analysis of critical success factors for ERP implementation projects.* Universitat Politècnica de Catalunya, Barcelona, Spain.

DE VAUJANY, F. X. 2003. Les figures de la gestion du changement sociotechnique: figures that manage sociotechnical change. *Sociologie du Travail,* 45**,** 515-536.

DELOITTE, C. 1998. ERP's second wave: maximizing the value of ERP-enabled processes. *Atlanta*.

DELORS, J. 1998. *Learning: The treasure within (Report to UNESCO of the International Commission on Education for the Twenty-first Century)*, Unesco.

DEMBLA, P. Year. Enterprise resource planning: business drivers and critical success factors. *In*, 1999. 40-51.

DENNING, S. 2001. *The springboard: How storytelling ignites action in knowledge-era organizations*, Butterworth-Heinemann Boston.

DEVLIN, B. 1997. *Data warehouse: from architecture to implementation*, Addison-Wesley.

DIAS, D. 2006. A 'Buy Button'in Your Brain? *National Post, July,* 1.

DIJKSTERHUIS, M. S., VAN DEN BOSCH, F. A. J. & VOLBERDA, H. W. 1999. Where do new organizational forms come from? Management logics as a source of coevolution. *Organization Science***,** 569-582.

DIXON, J. R., NANNI JR, A. J. & VOLLMANN, T. E. 1990. *The new performance challenge: Measuring operations for world-class competition*, Dow Jones-Irwin, Homewood, Ill.

DOOM, C., MILIS, K., POELMANS, S. & BLOEMEN, E. 2010. Critical success factors for ERP implementations in Belgian SMEs. *Journal of Enterprise Information Management,* 23**,** 378-406.

ECKERSON, W. W. 1998. Post-chasm warehousing. *Journal of Data Warehousing,* 3**,** 38-45.

EDWIN, T. 2006. Seven Steps in the ERP Process - An Overview of the Higher Ed ERP Journey.

EGGERT, A. & ULAGA, W. 2002. Customer perceived value: a substitute for satisfaction in business markets? *Journal of Business & Industrial Marketing,* 17**,** 107-118.

EHIE, I. C. & MADSEN, M. 2005. Identifying critical issues in enterprise resource planning (ERP) implementation. *Computers in Industry,* 56**,** 545-557.

EISENHARDT, K. M. 1989. Agency theory: An assessment and review. *Academy of management review,* 14**,** 57-74.

EL SAWY, O. A. & BOWLES, G. 1997. Redesigning the customer support process for the electronic economy: insights from storage dimensions. *MIS quarterly***,** 457-483.

ENDERS, A. & JELASSI, T. 2000. The converging business models of Internet and bricks-and-mortar retailers. *European Management Journal,* 18**,** 542-550.

ESCALLE, C. X., COTTELEER, M. J. & SCHOOL, H. U. H. B. 1999. *Enterprise resource planning (ERP): Technology note,* Harvard Business School.

ESHLAGHI, A., ASADOLLAHI, A. & POOREBRAHIMI, A. 2011. The Role of Enterprise Resources Planning (ERP) in the Contribution and Integration of the Information in the Supply Chain European Journal of Social Sciences – Volume 20, Number 1 (2011).

ESTEVES, J. & PASTOR, J. Year. An ERP lifecycle-based research agenda. *In*, 1999. 359-371.

ESTEVES, J. & PASTOR, J. Year. Towards the unification of critical success factors for ERP implementations. *In*, 2000. 1-2.

ESTEVES, J. & PASTOR, J. Year. Analysis of critical success factors relevance along SAP implementation phases. *In*, 2001. Citeseer, 1019-1025.

ETTORRE, B. 1993. Benchmarking: the next generation. *Management Review,* 82**,** 10-16.

EVANS, P. & WURSTER, T. S. 2000. Blown to bits. *How the new economics of information transforms strategy*.

EVERETT, D. 2003. Enhancing ERP System Value. Hyperion Solutions Corp.

FALK, M. 2005. ICT-linked firm reorganisation and productivity gains. *Technovation,* 25**,** 1229-1250.

FALKOWSKI, G., PEDIGO, P., SMITH, B. & SWANSON, D. 1998. A recipe for ERP success. *Beyond Computing,* 6**,** 44-45.

FALLON, M. 2005. Enterprise Resource Planning implementation through the use of Change Management and Critical Success Factors 29.

FAMA, E. F. & JENSEN, M. C. 1983. Separation of ownership and control. *Journal of law and economics,* 26**,** 301-325.

FAYYAD, U. & UTHURUSAMY, R. 2002. Evolving data into mining solutions for insights. *Communications of the ACM,* 45**,** 28-31.

FELIX, R. G. & HARRISON, W. L. 1984. Project Management Considerations for Distributed Processing Applications. *MIS quarterly***,** 161-170.

FENECH, T. & O'CASS, A. 2001. Internet users' adoption of Web retailing: user and product dimensions. *Journal of Product & Brand Management,* 10**,** 361-381.

FENN, J. 2010. Hype Cycle for Emerging Technologies, 2010.

FERGUSON, N. 1997. Data warehousing. *International Review of Law, Computers & Technology,* 11**,** 243-250.

FERNIE, J. 1995. The coming of the fourth wave: new forms of retail out-of-town development. *International Journal of Retail & Distribution Management,* 23**,** 4-11.

FEVAD 2010. 6e baromètre sur les comportements d'achats des internautes.

FEW, S. & ONLINE, S. B. 2006. *Information dashboard design*, O'Reilly.

FLIEDNER, G. 2003. CPFR: an emerging supply chain tool. *Industrial Management & Data Systems,* 103**,** 14-21.

FOSDICK, H. 1993. The Sociology of Technology Adaptation. *UNISPHERE,* 12**,** 48-48.

FRANZ, H. Year. Drowning in information when surfing the Web? Or going with the flow. *In,* 2000. IEEE, 11 pp. vol. 2.

FRYE, D. W. & GULLEDGE, T. R. 2007. End-to-end business process scenarios. *Industrial Management & Data Systems,* 107**,** 749-761.

FUGATE, D. L. 2007. Neuromarketing: a layman's look at neuroscience and its potential application to marketing practice. *Journal of Consumer Marketing,* 24**,** 385-394.

FULCHER, J. 1998. A common vision. *Manufacturing Systems,* 16**,** 88-94.

FURNELL, S. M. & KARWENI, T. 1999. Security implications of electronic commerce: a survey of consumers and businesses. *Internet Research,* 9**,** 372-382.

GABLE, G. & STEWART, G. 1999. SAP R/3 implementation issues for small to medium enterprises.

GABLE, G., VAN DEN HEEVER, R., SCOTT, J. & ERLANK, S. 1997. Large Packaged Software: the need for research.

GANGADHARAN, G. & SWAMI, S. N. Year. Business intelligence systems: design and implementation strategies. *In,* 2004. IEEE, 139-144 Vol. 1.

GANGULY, A. R. & GUPTA, A. 2005. Data mining technologies and decision support systems for business and scientific applications. *Encyclopedia of Data Warehousing and Mining*.

GANS, R. 1971. The uses of poverty: The poor pay all. *Issues in Urban Education*, 63.

GANT, J. 1992. Work Management: The Next Step in Imaging. *Chief Information Officer Journal, Autumn*, 60-64.

GARDINER, S. C., HANNA, J. B. & LATOUR, M. S. 2002. ERP and the reengineering of industrial marketing processes:: A prescriptive overview for the new-age marketing manager. *Industrial Marketing Management,* 31**,** 357-365.

GHOSH, A. K., HOWELL, C. & WHITTAKER, J. A. 2002. Building software securely from the ground up. *IEEE software,* 19**,** 14-16.

GHOSH, S. Year. Challenges on a global implementation of ERP software. *In:* Engineering Management Conference, 2002. IEMC '02. 2002 IEEE International, 2002 2002. 101-106 vol.1.

GIBBS, J. 1998. Going Live With SAP: New technology-new audit approaches. *Internal Auditor,* 55**,** 70-76.

GIBSON, M., ARNOTT, D., JAGIELSKA, I. & MELBOURNE, A. 2004. Evaluating the intangible benefits of business intelligence: review & research agenda. *Decision Support Systems Laboratory***,** 295-305.

GIBSON, N., HOLLAND, C. & LIGHT, B. 2001. A case study of a fast track SAP R/3 implementation at Guilbert. *Electronic Markets,* 9**,** 190-193.

GIBSON, N., HOLLAND, C. P. & LIGHT, B. Year. Enterprise resource planning: a business approach to systems development. *In*, 1999. IEEE, 9 pp.

GILAD, B., GILAD, T. & ASSOCIATION, A. M. 1988. *The business intelligence system: A new tool for competitive advantage,* American Management Association.

GILBERT, D. 1996. Relationship marketing and airline loyalty schemes. *Tourism Management,* 17**,** 575-582.

GILBERT, J. P. & SCHONBERGER, R. J. 1983. Inventory-based production control systems: A historical analysis. *PRODUCT. INVENT. MGMT.,* 24**,** 1-13.

GILLMANN, M., HERTEL, J., JUNG, C., KAUFMANN, G. & WOLBER, M. 2010. Cooking the Web-ERP. *On the Move to Meaningful Internet Systems 2002: CoopIS, DOA, and ODBASE***,** 602-617.

GOfiMAN, E. 1959. The presentation of self in everyday life. Garden City, NY: Doubleday Anchor Books.

GOLFARELLI, M., RIZZI, S. & CELLA, I. Year. Beyond data warehousing: what's next in business intelligence? *In*, 2004. ACM, 1-6.

GOODCHILD, M. F. 2006. Geographic information systems. *Progress in Human Geography,* 12**,** 560.

GRABSKI, S. V., LEECH, S. A. & SCHMIDT, P. J. 2011. A review of ERP research: A future agenda for accounting information systems. *Journal of Information Systems,* 25**,** 37-78.

GRADY, M. W. 1991. Performance measurement: implementing strategy. *Management Accounting,* 72**,** 49-53.

GRANLUND, M. & MALMI, T. 2002. Moderate impact of ERPS on management accounting: a lag or permanent outcome? *Management Accounting Research,* 13**,** 299-322.

GRANT, R. M. 2002. The resource-based theory of competitive advantage. *Strategy: Critical Perspectives on Business and Management,* 135.

GRAY, J., CHAUDHURI, S., BOSWORTH, A., LAYMAN, A., REICHART, D., VENKATRAO, M., PELLOW, F. & PIRAHESH, H. 1997. Data cube: A relational aggregation operator generalizing group-by, cross-tab, and sub-totals. *Data Mining and Knowledge Discovery,* 1**,** 29-53.

GRAY, P. 2003. Business intelligence: A new name or the future of DSS. *DSS in the Uncertainty of the Internet Age*.

GREER, S. A. 1989. *The logic of social inquiry,* Transaction Pub.

GRIFFITH, D. A. & KRAMPF, R. F. 1998. An examination of the web-based strategies of the top 100 US retailers. *Journal of Marketing Theory and Practice,* 6**,** 12-23.

GROMOFF, A., KAZANTSEV, N., KOZHEVNIKOV, D., PONFILENOK, M. & STAVENKO, Y. 2013. Newer Approach to Create Flexible Business Architecture of Modern Enterprise. *Global Journal of Flexible Systems Management***,** 1-9.

GRÖNROOS, C. 1993. The marketing strategy continuum: towards a marketing concept for the 1990s. *Management Decision,* 29.

GROSSMAN, R. & MAZZUCCO, M. 2002. DataSpace: a data Web for the exploratory analysis and mining of data. *Computing in Science & Engineering,* 4**,** 44-51.

GUILE, D. 1998. Information and communication technology and education Current concerns and emerging issues.

GULATI, R. & GARINO, J. 2000. Get the right mix of bricks & clicks. *Harvard business review,* 78**,** 107.

GULLA, J. A. & BRASETHVIK, T. 2002. A model-driven ERP environment with search facilities* 1. *Data & Knowledge Engineering,* 42**,** 327-341.

GUPTA, A. 2000. Enterprise resource planning: the emerging organizational value systems. *Industrial Management & Data Systems,* 100**,** 114-118.

GUPTA, A. 2009. Organization's External Environment.

GUPTA, H., HARINARAYAN, V., RAJARAMAN, A. & ULLMAN, J. D. Year. Index selection for OLAP. *In,* 1997. Published by the IEEE Computer Society, 208.

HÄKKINEN, L. & HILMOLA, O. P. 2008. Life after ERP implementation: Long-term development of user perceptions of system success in an after-sales environment. *Journal of Enterprise Information Management,* 21**,** 285-310.

HALLOWELL, R. 1996. The relationships of customer satisfaction, customer loyalty, and profitability: an empirical study. *International Journal of Service Industry Management,* 7**,** 27-42.

HAMEL, L. & HALL, T. 2000. A Brief Tutorial on Database Queries, Data Mining, and OLAP. Idea Group Publishers.

HAMILTON, D. 2008. Cloud computing' seen as next wave for technology investors, Financial Post 4. http://www.financialpost.com/money/story.html?id=562877 (18.07.08).

HAMMER, J., GARCIA-MOLINA, H., WIDOM, J., LABIO, W. & ZHUGE, Y. 1995. The Stanford Data Warehousing Project.

HAMMER, M. 1990. Reengineering work: don't automate, obliterate. *Harvard business review,* 68**,** 104-112.

HAMMER, M. 1995. The art of change. Success.

HAMMER, M. & CHAMPY, J. 1993. Reengineering the corporation: A manifesto for business revolution.

HAND, D. 2007. Principles of Data Mining. 2.

HAND, D. J., BLUNT, G., KELLY, M. G. & ADAMS, N. M. 2000. Data mining for fun and profit. *Statistical Science,* 15**,** 111-126.

HAND, D. J., MANNILA, H. & SMYTH, P. 2001. *Principles of data mining,* The MIT press.

HARDAKER, M. & WARD, B. 1987. Getting things done. *Harvard business review,* 65**,** 112-20.

HARRINGTON, H. J. 1991. *Business process improvement: The breakthrough strategy for total quality, productivity, and competitiveness,* McGraw-Hill Professional.

HARRINGTON, H. J., PRINCIPAL, E. & YOUNG, L. 1996. *The complete benchmarking implementation guide: Total benchmarking management,* McGraw-Hill.

HART, C., DOHERTY, N. & ELLIS-CHADWICK, F. 2000. Retailer adoption of the Internet–Implications for retail marketing. *European Journal of Marketing,* 34**,** 954-974.

HAX, A. & WILDE, D. 2002. The Delta Model--Toward a Unified Framework of Strategy. *MIT Sloan Working Paper No. 4261-02*.

HEINEMAN, G. T. & COUNCILL, W. T. 2001. Component-based software engineering: putting the pieces together. *Recherche,* 67**,** 02.

HEINEMANN, F. & RAU, C. 2003. Web Programming with the SAP® Web Application Server. *Outlook,* 80**,** 1.

HEMPEÎ, C. G. 1965. Aspects of scientific explanation.

HENDERSON, J. C. & VENKATRAMAN, N. 1991. Understanding strategic alignment. *Business Quarterly,* 55**,** 72-78.

HENDRICKX, H. H., DALEY, S. K., MAHAKENA, M. & VON ROSING, M. Year. Defining the Business Architecture Profession. *In:* Commerce and Enterprise Computing (CEC), 2011 IEEE 13th Conference on, 2011. IEEE, 325-332.

HENRY, A. 2008. *Understanding strategic management,* Oxford University Press, USA.

HENRY, J. 2001. *Creative management,* Sage Publications Ltd.

HESKETT, J. L., JONES, T. O., LOVEMAN, G. W., SASSER, W. E. & SCHLESINGER, L. A. 2008. Putting the service-profit chain to work. *Harvard business review*.

HICKS, D. A. & STECKE, K. E. 1995. The ERP maze: enterprise resource planning and other produtcion and inventory control sofwart-Here's simple-to-understand strategy for helping you improve your company's use of software-based. *IIE Solutions,* 27**,** 12-17.

HILBERT, M. & LÓPEZ, P. 2011. The world's technological capacity to store, communicate, and compute information. *Science,* 332**,** 60-65.

HIRT, S. G. & SWANSON, E. B. 2001. Emergent maintenance of ERP: new roles and relationships. *Journal of software maintenance and evolution: research and practice,* 13**,** 373-387.

HO, C. F., WU, W. H. & TAI, Y. M. 2004. Strategies for the adaptation of ERP systems. *Industrial Management & Data Systems,* 104**,** 234-251.

HOF, R. D. 2005. Mix, match, and mutate. *Business Week Magazine*.

HOFACKER, C. F. 2001. *Internet marketing,* John Wiley & Sons New York.

HOFFMAN, D. L., NOVAK, T. P. & CHATTERJEE, P. 1995. Commercial scenarios for the Web: Opportunities and challenges. *Journal of Computer-Mediated Communication,* 1**,** 0-0.

HOLLAND, C. & DAVIS, B. 1998. *FAQS about change management.* [Online]. Houston. Available: www.hdinc.com/faq_change_man_18.html [Accessed 2011].

HOLLAND, C. & LIGHT, B. 1999a. A critical success factors model for ERP implementation. *Software, IEEE,* 16**,** 30-36.

HOLLAND, C. P. & LIGHT, B. Year. Global enterprise resource planning implementation. *In*, 1999b. IEEE, 10 pp.

HOWARD RASHEED, P. & RASHEED, H. 2012. *Innovation Strategy: Seven Keys to Creative Leadership and a Sustainable Business Model*, iUniverse.

HUANG, A., YEN, D. C., CHOU, D. C. & XU, Y. 2003. Corporate applications integration: challenges, opportunities, and implementation strategies. *Journal of Business and Management*, 9**,** 137-150.

HUANG, C. Y. 2002. Distributed manufacturing execution systems: A workflow perspective. *Journal of Intelligent manufacturing,* 13**,** 485-497.

HUANG, M. H., WANG, J. C., YU, S. & CHIU, C. C. 2004a. Value-added ERP information into information goods: an economic analysis. *Industrial Management & Data Systems,* 104**,** 689-697.

HUANG, S. M., CHANG, I. C., LI, S. H. & LIN, M. T. 2004b. Assessing risk in ERP projects: identify and prioritize the factors. *Industrial Management & Data Systems,* 104**,** 681-688.

HUANG, S. M., HSIEH, P. G., TSAO, H. H. & HSU, P. Y. 2008. A structural study of internal control for ERP system environments: a perspective from the Sarbanes-Oxley Act. *International Journal of Management and Enterprise Development,* 5**,** 102-121.

HUIN, S. Year. Knowledge engineering in resources planning. *In*, 2002. IEEE, 1037-1042 vol. 2.

HULTMAN, K. E. 1979. The Path of Least Resistance. Preparing Employees for Change.

HUNTON, J. E., LIPPINCOTT, B. & RECK, J. L. 2003. Enterprise resource planning systems: comparing firm performance of adopters and nonadopters. *International Journal of Accounting Information Systems,* 4**,** 165-184.

HUTCHINS, H. Year. 7 Key Elements of a Successful Implementation and 8 Mistakes You Will Make Anyway. *In*, 1998. AMERICAN PRODUCTION AND INVENTORY CONTROL SOCIETY, 356-358.

IBM. 2011. *Bringing big data to the enterprise: what is big data?* [Online]. Available: http://www-01.ibm.com/software/data/bigdata/ [Accessed 14 October 2013].

INDIALGCNS. 2011. *ERP Implementation Methodology* [Online]. Available: http://www.lgcnsindia.com/erp_implementation.html [Accessed 17 July 2011 2011].

INMON, W. H. 2009. *Building the data warehouse,* Wiley-India.

JACOBS, A. 2009. The pathologies of big data. *Communications of the ACM,* 52**,** 36-44.

JACOBS, R. & WESTON, F. 2007. Enterprise resource planning (ERP)--A brief history. *Journal of Operations Management,* 25**,** 357-363.

JAMES, D. & WOLF, M. L. 2000. A second wind for ERP. *McKinsey Quarterly***,** 100-107.

JARKE, M. & POHL, K. Year. Establishing visions in context: towards a model of requirements processes. *In*, 1994. 49-62.

JARRAR, Y. & ASPINWALL, E. 1999. Business process re-engineering: Learning from organizational experience. *Total Quality Management & Business Excellence,* 10**,** 173-186.

JARVENPAA, S. L. & TODD, P. A. 1996. Consumer reactions to electronic shopping on the World Wide Web. *International Journal of Electronic Commerce,* 1**,** 59-88.

JOACHIM, D. 1998. Workflow automation crosses company lines. *InternetWeek,* 709.

JONES, M. A. 1999. Entertaining shopping experiences: an exploratory investigation. *Journal of Retailing and Consumer Services,* 6**,** 129-139.

JONES, M. C., CLINE, M. & RYAN, S. 2006. Exploring knowledge sharing in ERP implementation: an organizational culture framework. *Decision Support Systems,* 41**,** 411-434.

JUELS, A. 2006. RFID security and privacy: A research survey. *Selected Areas in Communications, IEEE Journal on,* 24**,** 381-394.

KALAKOTA, R. & ROBINSON, M. 2001. *E-business 2.0: Roadmap for Success,* Addison-Wesley Professional.

KALE, V. 2000. *Implementing SAP R/3: The guide for business and technology managers*, Sams.

KALLING, T. 2003. ERP systems and the strategic management processes that lead to competitive advantage. *Information Resources Management Journal,* 16**,** 46-67.

KANG, D. & SANTHANAM, R. 2003. A longitudinal field study of training practices in a collaborative application environment. *Journal of management information systems,* 20**,** 257-281.

KANGIS, P. & RANKIN, K. 1996. Interactive services: how to identify and target the new markets. *Journal of Marketing Practice: Applied Marketing Science,* 2**,** 44-67.

KAPLAN, A. M. & HAENLEIN, M. 2010. Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons,* 53**,** 59-68.

KAPLAN, R. S. & NORTON, D. P. 1992. The balanced scorecard–measures that drive performance. *Harvard business review,* 70**,** 71-79.

KARAGIANNOPOULOS, G., GEORGOPOULOS, N. & NIKOLOPOULOS, K. 2005. Fathoming Porter's five forces model in the internet era. *info,* 7**,** 66-76.

KATO, J., NAGATA, M., YAMAMOTO, S., SAEKI, M., KAIYA, H., HORAI, H., OHNISHI, A., KOMIYA, S. & WATAHIKI, K. 2003. PAORE: package oriented requirements elicitation.

KATZ, D. & KAHN, R. L. 1978. The social psychology of organizations.

KATZENBACH, J. R. & SMITH, D. K. 1993. *The wisdom of teams: Creating the high-performance organization*, Harvard Business Press.

KAUFMAN, L. M. 2009. Data security in the world of cloud computing. *Security & Privacy, IEEE,* 7**,** 61-64.

KAYWORTH, T., SAMBAMURTHY, V. & CHATTERJEE, D. 1997. ``A conceptual framework of information technology infrastructure: the critical link of technology standards". *Internet:[http://hsb. baylor. edu/ramsower/ais. ac. 97/papers/kayworth. htm]*.

KELLE, P. & AKBULUT, A. 2005. The role of ERP tools in supply chain information sharing, cooperation, and cost optimization. *International Journal of Production Economics,* 93**,** 41-52.

KELLEY, H., COMPEAU, D. & HIGGINS, C. 1999. Attribution analysis of computer self-efficacy. *AMCIS 1999 Proceedings***,** 270.

KELLY, K. 2011. *Everything. Web 2.0* [Online]. Available: http://www.web2expo.com/webexsf2011/public/schedule/proceedings [Accessed 14 October 2013].

KETTINGER, W. J., TENG, J. T. C. & GUHA, S. 1997. Business process change: a study of methodologies, techniques, and tools. *MIS quarterly***,** 55-80.

KHAN, A. M. A., AMIN, N. & LAMBROU, N. 2009. DRIVERS AND BARRIERS TO BUSINESS INTELLIGENCE ADOPTION: A CASE OF PAKISTAN.

KIMBALL, R. 1996. *The data warehouse toolkit: practical techniques for building dimensional data warehouses*, John Wiley & Sons, Inc.

KLAUS, H., ROSEMANN, M. & GABLE, G. G. 2000. What is ERP? *Information Systems Frontiers,* 2**,** 141-162.

KLEINER, B. M. 1994. Benchmarking for continuous performance improvement: tactics for success. *Environmental Quality Management,* 3**,** 283-295.

KLENZ, B. Year. The Quality Data Warehouse: Serving the Analytical Needs of the Manufacturing Enterprise. *In,* 1999. 521-529.

KLOSTERMEYER, A. & KLEMM, E. Year. PABADIS-an agent based flexible manufacturing concept. *In,* 2003. IEEE, 286-293.

KNUTSON, B., TAYLOR, J., KAUFMAN, M., PETERSON, R. & GLOVER, G. 2005. Distributed neural representation of expected value. *The journal of Neuroscience,* 25**,** 4806-4812.

KOCHAN, A. 2000. Real timely. *Works Management,* 53**,** 24.

KOGETSIDIS, H., KOKKINAKI, A. & SOTERIOU, V. 2008. Enterprise resource planning implementation in the retail sector: a case study on the effects of the implementation of an ERP system in Cyprus. *Journal for International Business and Entrepreneurship Development,* 3**,** 270-283.

KOH, S. & GUNASEKARAN, A. 2006. A knowledge management approach for managing uncertainty in manufacturing. *Industrial Management & Data Systems,* 106**,** 439-459.

KOH, S., SAAD, S. & PADMORE, J. 2004. Development and implementation of a generic order release scheme for modelling MRP-controlled finite-capacitated manufacturing environments. *International Journal of Computer Integrated Manufacturing,* 17**,** 561-576.

KOMOROWSKI, M. 2010. Hard drive cost per gygabyte 1980 - 2010 [Online]. Available: http://www.mkomo.com/ cost-per-gigabyte [Accessed 12 October 2012].

KORN, K. C. & PINE II, B. J. 2010. What Management Ought To Be.

KOVÁCS, G. L. & PAGANELLI, P. 2003. A planning and management infrastructure for large, complex, distributed projects--beyond ERP and SCM. *Computers in Industry,* 51**,** 165-183.

KRÆMMERGAARD, P. & MØLLER, C. Year. Evaluation of ERP implementation: A case-study of an implementation. *In,* 2001.

KRASNER, H. 2000. Ensuring e-business success by learning from ERP failures. *IT professional,* 2**,** 22-27.

KRAUSE, J. Electronic Commerce, Geschäftsfelder der Zukunft heute nutzen, 1998. ISBN 3-446-19378-2.

KUECHLER, W. L. 2007. Business applications of unstructured text. *Communications of the ACM,* 50**,** 86-93.

KUMAR, K. & VAN HILLEGERSBERG, J. 2000. ERP experiences and evolution. *Communications of the ACM,* 43**,** 23-26.

KUMAR MADRIA, S. 2001. Data warehousing. *Data & Knowledge Engineering,* 39**,** 215-217.

KUMAR, S. & HARMS, R. 2004. Improving business processes for increased operational efficiency: a case study. *Journal of Manufacturing Technology Management,* 15**,** 662-674.

KUMAR, V., MAHESHWARI, B. & KUMAR, U. 2002a. Enterprise resource planning systems adoption process: a survey of Canadian organizations. *International Journal of Production Research,* 40**,** 509-523.

KUMAR, V., MAHESHWARI, B. & KUMAR, U. 2002b. ERP systems implementation: best practices in Canadian government organizations. *Government Information Quarterly,* 19**,** 147-172.

KWON, O. & LEE, J. 2001. A multi-agent intelligent system for efficient ERP maintenance. *Expert Systems with Applications,* 21**,** 191-202.

LAFRAMBOISE, K. Year. Business performance and enterprise resource planning. *In*, 2002. Citeseer.

LAFRAMBOISE, K. & REYES, F. 2005. Gaining competitive advantage from integrating enterprise resource planning and total quality management. *Journal of Supply Chain Management,* 41**,** 49-64.

LANDER, M. C., PURVIS, R. L., MCCRAY, G. E. & LEIGH, W. 2004. Trust-building mechanisms utilized in outsourced IS development projects: a case study. *Information & Management,* 41**,** 509-528.

LANGENWALTER, G. A. 2000. *Enterprise resources planning and beyond: integrating your entire organization*, CRC.

LANGSETH, J. & VIVATRAT, N. 2003. Why proactive business intelligence is a hallmark of the real-time enterprise: outward bound. *Intelligent Enterprise,* 5**,** 34-41.

LAUDON, K. C., LAUDON, J. P. & HALL, P. P. 2004. Management information systems: managing the digital firm. *New Jersey,* 8.

LAUDON, K. C., LAUDON, J. P. & HALL, P. P. 2011. Management information systems: managing the digital firm. *New Jersey,* 8.

LAUGHLIN, S. P. 1993. An ERP game plan. *Journal of Business Strategy,* 20**,** 32-37.

LAWRENCE, P. R. & LORSCH, J. W. 1967. Managing differentiation and integration. *Organization and environment*.

LAZARUS, G. & WEXLER, B. 1988. *Marketing immunity: breaking through customer resistance,* Dow Jones-Irwin.

LEE-KELLEY, L., GILBERT, D. & MANNICOM, R. 2003. How e-CRM can enhance customer loyalty. *Marketing Intelligence & Planning,* 21**,** 239-248.

LEE, J., SIAU, K. & HONG, S. 2003. Enterprise Integration with ERP and EAI. *Communications of the ACM,* 46**,** 54-60.

LEE, N., BRODERICK, A. J. & CHAMBERLAIN, L. 2007. What is [] neuromarketing'? A discussion and agenda for future research. *International Journal of Psychophysiology,* 63**,** 199-204.

LEE, W. 2009. Build Web apps for iPhone using Dashcode.

LEI, T. 2002. BI Software Grows Amid Gloom', ACW Online, viewed 9 May 2003.

LENGNICK-HALL, C. A., LENGNICK-HALL, M. L. & ABDINNOUR-HELM, S. 2004. The role of social and intellectual capital in achieving competitive advantage through enterprise resource planning (ERP) systems. *Journal of Engineering and Technology Management,* 21**,** 307-330.

LEONARD-BARTON, D. 1998. *Wellsprings of knowledge: Building and sustaining the sources of innovation,* Harvard Business Press.

LIGHT, B. 2001. The maintenance implications of the customization of ERP software. *Journal of software maintenance and evolution: research and practice,* 13**,** 415-429.

LISIŃSKI, M. 2004. *Metody planowania strategicznego*, Polskie Wydaw. Ekonomiczne.

LISIŃSKI, M. & ŠARUCKIJ, M. 2006. Principles of the application of strategic planning methods. *Journal of Business Economics and Management,* 7**,** 37-43.

LIU, W., CHUA, T., LARN, J., WANG, F. & YIN, X. Year. APS, ERP and MES systems integration for semiconductor backend assembly. *In,* 2002. IEEE, 1403-1408 vol. 3.

LOH, T. & KOH, S. 2004. Critical elements for a successful enterprise resource planning implementation in small-and medium-sized enterprises. *International Journal of Production Research,* 42**,** 3433-3455.

LOOMBA, A. P. S. & JOHANNESSEN, T. B. 1997. Malcolm Baldrige National Quality Award: critical issues and inherent values. *Benchmarking: An International Journal,* 4**,** 59-77.

LUFTMAN, J. & BRIER, T. 1999. Achieving and sustaining business-IT alignment. *California Management Review,* 42**,** 109-122.

LUHN, H. P. 1958. A business intelligence system. *IBM Journal of Research and Development,* 2**,** 314-319.

LUI, K. M. & CHAN, K. C. C. 2008. Rescuing troubled software projects by team transformation: a case study with an ERP project. *Engineering Management, IEEE Transactions on,* 55**,** 171-184.

LUO, W. & STRONG, D. M. 2004. A framework for evaluating ERP implementation choices. *Engineering Management, IEEE Transactions on,* 51**,** 322-333.

LUSCH, R. F., LIU, Y. & CHEN, Y. 2010. The Phase Transition of Markets and Organizations: The New Intelligence and Entrepreneurial Frontier. IEEE COMPUTER SOC 10662 LOS VAQUEROS CIRCLE, PO BOX 3014, LOS ALAMITOS, CA 90720-1314 USA.

MA, C., CHOU, D. C. & YEN, D. C. 2000. Data warehousing, technology assessment and management. *Industrial Management & Data Systems,* 100**,** 125-135.

MABERT, V. A., SONI, A. & VENKATARAMANAN, M. 2001. Enterprise resource planning: common myths versus evolving reality. *Business Horizons,* 44**,** 69-76.

MABERT, V. A., SONI, A. & VENKATARAMANAN, M. 2003. The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector. *Omega,* 31**,** 235-246.

MACEACHREN, A. M. & KRAAK, M. J. 2001. Research challenges in geovisualization. *Cartography and Geographic Information Science,* 28**,** 3-12.

MAHER, J. 1999. ERP in industry: Automate and integrate. *The Engineers' Journal*.

MANYIKA, J., CHUI, M., BROWN, B., BUGHIN, J., DOBBS, R., ROXBURGH, C. & BYERS, A. H. 2011. Big data: The next frontier for innovation, competition, and productivity.

MARKUS, M. L., AXLINE, S., PETRIE, D. & TANIS, S. C. 2001. Learning from adopters' experiences with ERP: problems encountered and success achieved. *Journal of Information Technology,* 15**,** 245-265.

MARKUS, M. L. & TANIS, C. 2000. The enterprise systems experience-from adoption to success. *Framing the domains of IT research: Glimpsing the future through the past,* 173**,** 207-173.

MARKUS, M. L., TANIS, C. & VAN FENEMA, P. C. 2000. Enterprise resource planning: multisite ERP implementations. *Communications of the ACM,* 43**,** 42-46.

MARTIN, I. & CHEUNG, Y. 2000. SAP and business process re-engineering. *Business Process Management Journal,* 6**,** 113-121.

MARTIN, M. 1998. An ERP strategy. *Fortune,* 2**,** 95-97.

MARUCA, R. F., BURKE, R., GREENBURY, R., QUELCH, J. & SMITH, R. A. 1999. Retailing: confronting the challenges that face bricks-and-mortar stores. *Harvard business review,* 77**,** 159-170.

MAULL, R. & CHILDE, S. 1994. Business process re-engineering: an example from the banking sector. *International Journal of Service Industry Management,* 5**,** 26-34.

MCADAM, R. & GALLOWAY, A. 2005. Enterprise resource planning and organisational innovation: a management perspective. *Industrial Management & Data Systems,* 105**,** 280-290.

MCCUNE, J. 1994. Measuring the value of employee education. *Management Review,* 83**,** 10-15.

MCDOUGALL, G. H. G. & LEVESQUE, T. 2000. Customer satisfaction with services: putting perceived value into the equation. *Journal of services marketing,* 14**,** 392-410.

MCGEE, M. 1998. GIFT COMPANY GETS R/3 HELP. *InformationWeek***,** 166.

MCGRATH, J. E. 1984. *Groups: Interaction and performance,* Prentice-Hall Englewood Cliffs, NJ.

MCKERSIE, R. B. & WALTON, R. E. 1991. Organizational change. *The Corporation of the 1990s: Information Technology and Organizational Transformation, Oxford University Press, New York***,** 244-277.

MCKINNON, S. M. & BRUNS, W. J. 1992. *The information mosaic*, Harvard Business Press.

MENDEL, B. 1999. Overcoming ERP project hurdles. *InfoWorld,* 21**,** 87.

MEYER, J. P. & ALLEN, N. J. 1991. A three-component conceptualization of organizational commitment. *Human resource management review,* 1**,** 61-89.

MICROSOFT 2010. 'Business Driver Definition'. Microsoft Company Web Site. https://partner.microsoft.com/us/40030337, accessed Februaryt 2012.

MILFORD, M. & STEWART, G. 2000. Are ERP Implemenations Qualitatively Different from Other Large Systems Implementations?

MINAHAN, T. 1998. Strategies Not Included,". Purchasing.

MINTZBERG, H. 1987. Crafting strategy. *Harvard business review,* 65**,** 66-75.

MINTZBERG, H. & WATERS, J. A. 1985. Of strategies, deliberate and emergent. *Strategic management journal,* 6**,** 257-272.

MITTELSTAEDT, R. 1992. Benchmarking: How to learn from best in class practices. *National Productivity Review,* 11**,** 301-315.

MOMOH, A., ROY, R. & SHEHAB, E. 2010. Challenges in enterprise resource planning implementation: state-of-the-art. *Business Process Management Journal,* 16**,** 537-565.

MONTREUIL, B., FRAYRET, J. M. & D'AMOURS, S. 2000. A strategic framework for networked manufacturing. *Computers in Industry,* 42**,** 299-317.

MOON, S., BIRCHALL, D., WILLIAMS, S. & VRASIDAS, C. 2005. Developing design principles for an e-learning programme for SME managers to support accelerated learning at the workplace. *Journal of Workplace Learning,* 17**,** 370-384.

MOON, Y. B. & PHATAK, D. 2005. Enhancing ERP system's functionality with discrete event simulation. *Industrial Management & Data Systems,* 105**,** 1206-1224.

MOORE, G. A. 2002. *Crossing the chasm: Marketing and selling high-tech products to mainstream customers,* HarperBusiness.

MOSS, L. T. & ATRE, S. 2003. *Business intelligence roadmap: the complete project lifecycle for decision-support applications,* Addison-Wesley Professional.

MOTWANI, J., MIRCHANDANI, D., MADAN, M. & GUNASEKARAN, A. 2002. Successful implementation of ERP projects: evidence from two case studies. *International Journal of Production Economics,* 75**,** 83-96.

MULLIN, R. 1997. IT integration programmed for global operation. *Chemical week*, 159**,** 21-27.

MURRAY, M. & COFFIN, G. 2001. A case study analysis of factors for success in ERP system implementations. *AMCIS 2001 Proceedings***,** 196.

NAH, F. F. H., LAU, J. L. S. & KUANG, J. 2001. Critical factors for successful implementation of enterprise systems. *Business Process Management Journal,* 7**,** 285-296.

NAHAPIET, J. & GHOSHAL, S. 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of management review***,** 242-266.

NEGASH, S. 2004. Business intelligence. *The Communications of the Association for Information Systems,* 13**,** 54.

NELSON, G. & WRIGHT, J. 2005. Real time decision support: creating a flexible architecture for real time analytics. *DSSResources. COM,* 11**,** 18.

NEMATI, H. R., STEIGER, D. M., IYER, L. S. & HERSCHEL, R. T. 2002. Knowledge warehouse: an architectural integration of knowledge management, decision support, artificial intelligence and data warehousing. *Decision Support Systems,* 33**,** 143-161.

NEWELL, S., HUANG, J., GALLIERS, R. & PAN, S. 2003. Implementing enterprise resource planning and knowledge management systems in tandem: fostering efficiency and innovation complementarity. *Information and Organization,* 13**,** 25-52.

NEWTON, H. 2001. *Newton's telecom dictionary*, Cmp Books.

NG, C., GABLE, G. & CHAN, T. 2002. An ERP-client benefit-oriented maintenance taxonomy. *Journal of Systems and Software*, 64**,** 87-109.

NG, J. & IP, W. 2003. Web-ERP: the new generation of enterprise resources planning. *Journal of materials processing technology,* 138**,** 590-593.

NICOLAOU, A. 2013. Best practices on the move: building web apps for mobile devices. *Queue,* 11**,** 30.

NICOLAOU, A. I. 2004. Quality of postimplementation review for enterprise resource planning systems. *International Journal of Accounting Information Systems,* 5**,** 25-49.

NONAKA, I. & TAKEUCHI, H. 2007. The knowledge-creating company. *Harvard business review,* 85**,** 162.

NUNAN, D. D. D., M. 2013. Market research and the ethics of big data. *International Journal of Market Research,* 55**,** p.505–520.

O'LEARY, D. E. 2002. Knowledge management across the enterprise resource planning systems life cycle. *International Journal of Accounting Information Systems,* 3**,** 99-110.

O'LEARY, D. E. 2008. Gartner's hype cycle and information system research issues. *International Journal of Accounting Information Systems,* 9**,** 240-252.

O'GORMAN, B. 2004. The Road to ERP—Has Industry Learned or Revolved Back to the Start? *The enterprise resource planning decade: lessons learned and issues for the future***,** 22.

ODEN, H. W., LANGENWALTER, G. A. & LUCIER, R. A. 1993. *Handbook of material & capacity requirements planning*, McGraw-Hill New York etc.

OLIVER, D. & ROMM, C. 2000. ERP systems: The route to adoption. *AMCIS 2000 Proceedings***,** 209.

ORLIKOWSKI, W. J. & BARLEY, S. R. 2001. Technology and institutions: what can research on information technology and research on organizations learn from each other? *MIS quarterly***,** 145-165.

OWEN, J. V. 1992. Benchmarking: World-Class Manufacturing.

PAAP, J. & KATZ, R. 2004. Anticipating disruptive innovation. *Research-Technology Management,* 47**,** 13-22.

PAN, S. L. & LEE, J. N. 2003. Using e-CRM for a unified view of the customer. *Communications of the ACM,* 46**,** 95-99.

PARK, C. H. & KIM, Y. G. 2003. A framework of dynamic CRM: linking marketing with information strategy. *Business Process Management Journal,* 9**,** 652-671.

PARK, K. & KUSIAK*, A. 2005. Enterprise resource planning (ERP) operations support system for maintaining process integration. *International Journal of Production Research,* 43**,** 3959-3982.

PARR, A. & SHANKS, G. Year. A taxonomy of ERP implementation approaches. *In*, 2000. Published by the IEEE Computer Society, 7018.

PARSAYE, K. 1997. A characterization of data mining technologies and processes. *Journal of Data Warehousing,* 2**,** 2–15.

PARSONS, A. G. 2002. Non-functional motives for online shoppers: why we click. *Journal of Consumer Marketing,* 19**,** 380-392.

PARVATIYAR, A. & SHETH, J. N. 2001. *Conceptual framework of customer relationship management*, New Delhi, India: Tata/McGraw-Hill.

PASTOR, J. & SALGADO, J. 2000. Towards the Unification of Critical Success Factors for ERP implementations.

PAWLOWSKI, S. 1999. Constraints and flexibility in enterprise systems: A dialectic of system and job. *AMCIS 1999 Proceedings***,** 273.

PAYNE, A. & FROW, P. 2005. A strategic framework for customer relationship management. *Journal of Marketing,* 69**,** 167-176.

PEFFERS, K., GENGLER, C. E. & TUUNANEN, T. 2003. Extending critical success factors methodology to facilitate broadly participative information systems planning. *Journal of management information systems,* 20**,** 51-85.

PEPPERS, D. & ROGERS, M. 1995. A new marketing paradigm: share of customer, not market share. *Strategy & Leadership,* 23**,** 14-18.

PEPPERS, D. & ROGERS, M. 2002. *The One to One Manager: Real-World Lessons in Customer Relationship Management*, Crown Business.

PEREIRA, C. M. & SOUSA, P. Year. Enterprise architecture: business and IT alignment. *In:* Proceedings of the 2005 ACM symposium on Applied computing, 2005. ACM, 1344-1345.

PESLAK, A., SUBRAMANIAN, G. & CLAYTON, G. 2008. The phases of ERP software implementation and maintenance: A model for predicting preferred ERP use. *Journal of Computer Information Systems,* 48**,** 25.

PETERSON, R. 2004. Crafting information technology governance. *Information systems management,* 21**,** 7-22.

PHAU, I. & POON, S. M. 2000. Factors influencing the types of products and services purchased over the Internet. *Internet Research,* 10**,** 102-113.

PIKE, J. & BARNES, R. 1996. *TQM in action: a practical approach to continuous performance improvement*, Springer.

PLOTKIN, H. 1999. ERPs: How to make them work. *Harvard Management Update,* 4.

POITOU, J. 2011. *Emerging markets fuel demands for smartphones* [Online]. Available: http://www.telecomasia.net/content/emerging-markets-fuel-demand-smartphones?page=0%2C1 [Accessed 12 October 2013].

POPPER, K. R. 2002. *The logic of scientific discovery*, Psychology Press.

PORTER, M. E. 1998. *Competitive advantage: creating and sustaining superior performance: with a new introduction*, Free Pr.

PORTER, M. E. 2001a. Strategy and the Internet. *Harvard business review,* 79**,** 62-79.

PORTER, M. E. 2001b. Strategy and the Internet Harvard Business Review. *March, pp62-78. Retrieved July,* 20**,** 2007.

PORTER, M. E. 2002. What is strategy? *Strategy for business: A reader***,** 10-31.

PORTER, M. E. & MILLAR, V. E. 1985. How information gives you competitive advantage. *Harvard business review,* 63**,** 149-160.

PRESSMAN, R. S. 2001. Software Engineering--{A} Practitioner\'s Approach.

PTAK, C. A. & SCHRAGENHEIM, E. 2004. *ERP: tools, techniques, and applications for integrating the supply chain,* CRC.

PUMPHREY, S. J. 2003. ‘‘The new enterprise portal economics’’, International Journal of e-Business Strategy Management, Vol. 14 No. 4, pp. 289-302.

QUATTRONE, P. & HOPPER, T. 2005. A time-space odyssey': management control systems in two multinational organisations. *Accounting, Organizations and Society,* 30**,** 735-764.

RADDER, L. & LOUW, L. 1998. The SPACE matrix: A tool for calibrating competition. *Long Range Planning,* 31**,** 549-559.

RADDING, A. 1998. The push to integrate-packaged applications promise to speed integration and cut costs. *Information Week*.

RAMAMURTHY, K. 2007. An Empirical Investigation of the Key Determinants of Data Warehouse Adoption Decision Support Systems,’ 44(4), 817-841. Lubar School of Business, University of Wisconsin-Milwaukee, October 2007, http://www.sciencedirect.com/, accessed February 2012.

RAMPERSAD, H. K. 2001. *Total quality management: an executive guide to continuous improvement*, Springer.

RANJAN, J. 2009. Business Intelligence: Concepts, Components, Techniques and Benefits. *Journal of Theoretical and Applied Information Technology,* 9**,** 60-70.

RAO, S. S. 2000. Enterprise resource planning: business needs and technologies. *Industrial Management & Data Systems,* 100**,** 81-88.

REEDY, J., SCHULLO, S. & ZIMMERMAN, K. 2004. *Electronic marketing: integrating electronic resources into the marketing process*, Thomson/South-Western Mason, OH.

REICHHELD, F. F. & SASSER JR, W. 1990. ``Zero defects comes to services". *Harvard business review***,** 105-11.

REICHHELD, F. F. & SASSER, W. E. 1990. Zero defections: quality comes to services. *Harvard business review,* 68**,** 105-111.

REICHHELD, F. F. & SCHEFTER, P. 2000. *E-loyalty: your secret weapon on the web*, Harvard Business School Press.

REICHHELD, F. F. & TEAL, T. 2001. *The loyalty effect: The hidden force behind growth, profits, and lasting value*, Harvard Business Press.

REID, A. 2006. MRI Scanners Can Improve Advertising Effectiveness. *The Economic Times, January*, 19.

REID, E. O. F. Year. Identifying a company's noncustomer online communities: a proto-typology. *In*, 2003. IEEE, 8 pp.

RENVOISÉ, P. & MORIN, C. 2005. *Neuro-marketing: is there a'buy button'inside the brain?: selling to the old brain for instant success*, Thomas Nelson Inc.

RICHARDSON, J., SCHLEGEL, K., HOSTMANN, B. & MCMURCHY, N. 2008. Magic quadrant for business intelligence platforms. *Gartner RAS Core Research Note G,* 154227.

RISHI, M. 2012. Innovations Around Mobile Applications: Scope for Indian Developers. *Journal of Technology Management for Growing Economies,* Vol. 3 p119-136. 18p.

RIVEST, S., BÉDARD, Y. & MARCHAND, P. 2001. Toward better support for spatial decision making: defining the characteristics of spatial on-line analytical processing (SOLAP). *GEOMATICA-OTTAWA-*, 55**,** 539-555.

ROACH, S. S. & STANLEY, M. 1987. *America's technology dilemma: A profile of the information economy*, Morgan Stanley.

ROBBINS, S. P., COULTER, M. & STUART-KOTZE, R. 1997. Management. 5"• Ed. *Can. Scarborough, Ont.: Prentice Hall Canada*.

ROBERTS, H. & BARRAR, P. 1992. MRPII implementation: key factors for success. *Computer Integrated Manufacturing Systems,* 5**,** 31-38.

ROCKART, J. F. 1979. Chief executives define their own data needs. *Harvard business review,* 57**,** 81.

ROSARIO, J. 2000. On the leading edge: critical success factors in ERP implementation projects. *Business World,* 17**,** 15-29.

ROSE, G., KHOO, H. & STRAUB, D. W. 1999. Current technological impediments to business-to-consumer electronic commerce. *Communications of the AIS,* 1**,** 1.

ROSS, J. 1999a. The ERP Revolution: Surviving versus Thriving, Centre for IS Research, Sloan School of Management. MIT, Cambridge, USA.

ROSS, J. W. 1999b. Surprising facts about implementing ERP. *IT professional,* 1**,** 65-68.

ROSS, J. W. & VITALE, M. R. 2000. The ERP revolution: surviving vs. thriving. *Information Systems Frontiers,* 2**,** 233-241.

ROTHWELL, W. J. & KAZANAS, H. 1999. *Building in-house leadership and management development programs: Their creation, management, and continuous improvement*, Quorum Books.

ROUIBAH, K. & OULD-ALI, S. 2002. PUZZLE: a concept and prototype for linking business intelligence to business strategy. *The Journal of Strategic Information Systems,* 11**,** 133-152.

ROWE, A. J., MASON, R. O., DICKEL, K. E. & SPARKS, J. E. 1985. *Strategic management and business policy: A methodological approach*, Addison-Wesley Pub. Co.

ROWLEY, J. 2000. Product search in e-shopping: a review and research propositions. *Journal of Consumer Marketing,* 17**,** 20-35.

RUSSO, N., KREMER, A. & BRANDT, I. 1999. Enterprise-wide software: factors affecting implementation and impacts on the IS function. *Communication World,* 25**,** 30-42.

RYALS, L. & KNOX, S. 2001. Cross-functional issues in the implementation of relationship marketing through customer relationship management. *European Management Journal,* 19**,** 534-542.

RYALS, L. & PAYNE, A. 2001. Customer relationship management in financial services: towards information-enabled relationship marketing. *Journal of Strategic Marketing,* 9**,** 3-27.

RYGIELSKI, C., WANG, J. C. & YEN, D. C. 2002. Data mining techniques for customer relationship management. *Technology in Society,* 24**,** 483-502.

S. HAMAKER, A. H. 2004. Principles of IT governance. *Information Systems Control Journal (2)***,** 1–4.

SAATY, T. L. 1980. Analytic hierarchy process. *Encyclopedia of Biostatistics*.

SAMBAMURTHY, V. & ZMUD, R. W. 1999. Arrangements for information technology governance: a theory of multiple contingencies. *MIS quarterly***,** 261-290.

SAMBROOK, S. 2003. E-learning in small organisations. *Education+ Training,* 45**,** 506-516.

SAMMON, D. & ADAM, F. 2004a. ERP Software Selection Widening the Current Debate. *The enterprise resource planning decade: lessons learned and issues for the future***,** 58.

SAMMON, D. & ADAM, F. 2004b. Setting the Scene—Defining and Understanding ERP Systems. *The enterprise resource planning decade: lessons learned and issues for the future***,** 1.

SARKIS, J. & SUNDARRAJ, R. 2003. Managing large-scale global enterprise resource planning systems: a case study at Texas Instruments* 1. *International Journal of Information Management,* 23**,** 431-442.

SCALZO, B. 2003. *Oracle DBA guide to data warehousing and star schemas,* Prentice Hall.

SCHEER, A. & HABERMANN, F. 2000. Making ERP a success. *COMMUNICATIONS-ACM,* 43**,** 57-62.

SCHERMERHORN JR, J. R. 2010. *Management,* Wiley.

SCHILLER, R. 1987. "Out of town exodus" In McFayden, E. (ed.), The Changing Face of British Retailing, London: Newman Books, 64–73.

SCHLICHTER, B. R. & KRAEMMERGAARD, P. 2010. A comprehensive literature review of the ERP research field over a decade. *Journal of Enterprise Information Management,* 23**,** 486-520.

SCHNIEDERJANS, M. J. & KIM, G. C. 2003. Implementing enterprise resource planning systems with total quality control and business process reengineering: survey results. *International Journal of Operations & Production Management,* 23**,** 418-429.

SEDDON, P. B. 2005. Are ERP systems a source of competitive advantage? *Strategic Change,* 14**,** 283-293.

SEETHARAMAN, K. 1998. The CORBA connection. *Communications of the ACM,* 41**,** 34-36.

SEIN, M. K., BOSTROM, R. P. & OLFMAN, L. 2001. Rethinking end-user training strategy: applying a hierarchical knowledge-level model. *Strategies for managing computer software upgrades,* 153.

SENGE, P. M. 1993. The Fifth Discipline: The Art and Practice of the Learning Organization: Book review.

SEO, M. G. & BARRETT, L. F. 2007. Being emotional during decision making—Good or bad? An empirical investigation. *The Academy of Management Journal ARCHIVE,* 50**,** 923-940.

SHAKIR, M. 2000. Decision making in the evaluation, selection and implementation of ERP systems. *AMCIS 2000 Proceedings***,** 93.

SHANKS, G., PARR, A., HU, B., CORBITT, B., THANASANKIT, T. & SEDDON, P. Year. Differences in critical success factors in ERP systems implementation in Australia and China: a cultural analysis. *In*, 2000. Citeseer, 537-544.

SHEHAB, E., SHARP, M., SUPRAMANIAM, L. & SPEDDING, T. A. 2004. Enterprise resource planning: An integrative review. *Business Process Management Journal,* 10**,** 359-386.

SHERRARD, R. Year. Enterprise resource planning is not for the unprepared. *In*, 1998.

SHOSHANI, A. Year. OLAP and statistical databases: Similarities and differences. *In*, 1997. ACM, 185-196.

SINCLAIR, D. & ZAIRI, M. 2000. Performance measurement: a critical analysis of the literature with respect to total quality management. *International Journal of Management Reviews,* 2**,** 145-168.

SIRIGINIDI, S. R. 2000. Enterprise resource planning in reengineering business. *Business Process Management Journal,* 6**,** 376-391.

SLATER, D. 1998. The Hidden Costs of Enterprise Software: IT Budgeting. *CIO-FRAMINGHAM MA-,* 11**,** 48-55.

SLEVIN, D. P. & PINTO, J. K. 1987. Balancing strategy and tactics in project implementation. *Sloan Management Review,* 29**,** 33-41.

SMYTH, P., PREGIBON, D. & FALOUTSOS, C. 2002. Data-driven evolution of data mining algorithms. *Communications of the ACM,* 45**,** 33-37.

SOFFER, P., GOLANY, B. & DORI, D. 2003. ERP modeling: a comprehensive approach. *Information systems,* 28**,** 673-690.

SOH, C., KIEN, S. S. & TAY-YAP, J. 2000. Enterprise resource planning: cultural fits and misfits: is ERP a universal solution? *Communications of the ACM,* 43**,** 47-51.

SOLOW, R. M. 1987. We'd Better Watch Out New York Times Book Review. *New York*.

SOMERS, T. & NELSON, K. Year. The impact of critical success factors across the stages of enterprise resource planning implementations. *In,* 2001. Published by the IEEE Computer Society, 8016.

SOMERS, T. M. & NELSON, K. G. 2003. The impact of strategy and integration mechanisms on enterprise system value: Empirical evidence from manufacturing firms. *European Journal of Operational Research,* 146**,** 315-338.

SPENCER, H. 1898. *The principles of sociology,* D. Appleton and company.

SPENDOLINI, M. J. 1992. The benchmarking process. *Compensation & Benefits Review,* 24**,** 21.

SPROTT, D. 2000. Enterprise resource planning: componentizing the enterprise application packages. *Communications of the ACM,* 43**,** 63-69.

SRINIVASAN, L. & TREADWELL, J. 2005. An overview of service-oriented architecture, web services and grid computing. *HP Software Global Business Unit,* 2.

STACKOWIAK, R., RAYMAN, J. & GREENWALD, R. 2007. *Oracle Data Warehousing & Business Intelligence So,* Wiley-India.

STANK, T. P., ROGERS, D. S. & DAUGHERTY, P. 1994. Benchmarking: applications by third party warehousing firms. *Logistics and Transportation Review,* 30**,** 55-72.

STAVENKO, Y. & GROMOFF, A. 2011. A study of the subject-oriented approach for automation and process modeling of a service company. *Subject-Oriented Business Process Management.* Springer.

STEDMAN, C. 1998. Customer data faces rough road to factory. *Computerworld,* 32**,** 1.

STEDMAN, C. 1999. Survey: ERP costs more than measurable ROI. *Computerworld,* 33**,** 6.

STEFANOU, C. J. 2000. The selection process of enterprise resource planning (ERP) systems. *AMCIS 2000 Proceedings***,** 418.

STEIN, T. 1998. Extending ERP. *InformationWeek,* 686**,** 75-72.

STEVENS, T. 1998a. Just in case. *Industry Week,* 246**,** 15-28.

STEVENS, T. 1998b. Proof positive. *Industry Week,* 247**,** 22-28.

STEWART, G. 2000. Organisational readiness for ERP implementation. *AMCIS 2000 Proceedings***,** 291.

STORBACKA, K., ECONOMICS, S. S. O. & ADMINISTRATION, B. 1993. *Customer relationship profitability in retail banking*, SHH.

STRADER, T. J. & SHAW, M. J. 1999. Consumer cost differences for traditional and Internet markets. *Internet Research,* 9**,** 82-92.

STRATMAN, J. & ROTH, A. Year. Enterprise resource planning competence: a model, propositions and pre-test, design-stage scale development. *In*, 1999. 1199-201.

STURDY, G. R. 2010. *Business process reengineering : strategies for occupational health and safety*, Newcastle upon Tyne, UK, Cambridge Scholars Pub.

SUMNER, M. Year. Critical success factors in enterprise wide information management systems projects. *In*, 1999. ACM, 297-303.

TAKARAGI, K., USAMI, M., IMURA, R., ITSUKI, R. & SATOH, T. 2001. An ultra small individual recognition security chip. *Micro, IEEE,* 21**,** 43-49.

TAPSCOTT, D. 2004. The engine that drives success. *CIO-FRAMINGHAM MA-,* 17**,** 36-43.

TARN, J. M., YEN, D. C. & BEAUMONT, M. 2002. Exploring the rationales for ERP and SCM integration. *Industrial Management & Data Systems,* 102**,** 26-34.

TASLAK, S. 2004. Factors restricting success of strategic decisions: Evidence from the Turkish textile industry. *European Business Review,* 16**,** 152-164.

TAYLOR, J. C. 1998. Participative design: linking BPR and SAP with an STS approach. *Journal of Organizational Change Management,* 11**,** 233-245.

TAYLOR, R., GROH, T. & HATFIELD, G. 2004. Supply chain management and business intelligence: learning from our ERP and CRM mistakes. *DM Review*.

TELTUMBDE, A. 2000. A framework for evaluating ERP projects. *International Journal of Production Research,* 38**,** 4507-4520.

THEARLING, K. 2001. An Introduction to Data Mining: Discovering hidden value in your data warehouse. *White Paper, URL: http://www. thearling. com/text/dmwhite/dmwhite. htm*.

THEMISTOCLEOUS, M., IRANI, Z., O'KEEFE, R. M. & PAUL, R. Year. ERP problems and application integration issues: An empirical survey. *In*, 2001. IEEE, 10 pp.

THOMPSON, C. 2003. There's a sucker born in every medial prefrontal cortex. *New York Times,* 26.

TOFFLER, A. 1980. The third wave: The classic study of tomorrow. *New York: Bantam*.

TOROK, R. M. & CORDON, P. J. 2002. *Operational profitability: systematic approaches for continuous improvement,* John Wiley & Sons Inc.

TRITES, G. 2004. Director responsibility for IT governance. *International Journal of Accounting Information Systems,* 5**,** 89-99.

TRUNICK, P. A. 1999. ERP: promise or pipe dream? *Transportation & Distribution,* 40**,** 23-26.

TURBAN, E., KING, D., LEE, J. & VIEHLAND, D. 2004. *Electronic Commerce: a managerial perspective 2004*, Prentice Hall.

TURBAN, E., MCLEAN, E. & WETHERBE, J. 2001. Information Technology for Management, Making Connections for Strategic Advantage. John Wiley&Sons. *Inc., New York*.

TURBAN, E., SHARDA, R., ARONSON, J. E. & KING, D. N. 2008. *Business intelligence: a managerial approach*, Pearson Prentice Hall.

TUSHMAN, M. & O'REILLY, C. A. 2002. *Winning through innovation: A practical guide to leading organizational change and renewal*, Harvard Business Press.

TVRDIKOVA, M. 2007. Support of decision making by business intelligence tools.

UMBLE, E. J., HAFT, R. R. & UMBLE, M. M. 2003. Enterprise resource planning: Implementation procedures and critical success factors. *European Journal of Operational Research,* 146**,** 241-257.

UNDERHILL, P. 2008. *Why we buy: The science of shopping*, Simon and Schuster.

VAN DER AALST, W. M. P. & WEIJTERS, A. 2004. Process mining: a research agenda. *Computers in Industry,* 53**,** 231-244.

VAN EVERDINGEN, Y., VAN HILLEGERSBERG, J. & WAARTS, E. 2000. Enterprise resource planning: ERP adoption by European midsize companies. *Communications of the ACM,* 43**,** 27-31.

VAN STIJN, E. & WENSLEY, A. 2001. Organizational memory and the completeness of process modeling in ERP systems: some concerns, methods and directions for future research. *Business Process Management Journal,* 7**,** 181-194.

VARIAN, H. R. 2004. How much does information technology matter. *New York Times,* 6.

VASILASH, G. 1994. Benchmarking: A Few Things You Should Think About. *Production, June***,** 54-55.

VASSOS, T. 1996. *Strategic internet marketing*, Que Corp.

VEDDER, R. G., VANECEK, M. T., GUYNES, C. S. & CAPPEL, J. J. 1999. CEO and CIO perspectives on competitive intelligence. *Communications of the ACM,* 42**,** 108-116.

VERSTEEG, G. & BOUWMAN, H. 2006. Business architecture: A new paradigm to relate business strategy to ICT. *Information Systems Frontiers,* 8**,** 91-102.

VERVILLE, J. & HALINGTEN, A. 2002. An investigation of the decision process for selecting an ERP software: the case of ESC. *Management Decision,* 40**,** 206-216.

VERWIJMEREN, M. 2004. Software component architecture in supply chain management. *Computers in Industry,* 53**,** 165-178.

VIJAYASARATHY, L. R. & JONES, J. M. 2000. Print and Internet catalog shopping: assessing attitudes and intentions. *Internet Research,* 10**,** 191-202.

WALLACE, W. L. 1971. *The logic of science in sociology,* Aldine de Gruyter.

WARD, B. 1990. Planning for profit. *Managing Information Systems for Profit. Chichester: John Wiley & Sons***,** 103-146.

WATSON, E. E. & SCHNEIDER, H. 2001. Using ERP systems in education. *Communications of the AIS,* 1**,** 3.

WATSON, H. J., GOODHUE, D. L. & WIXOM, B. H. 2002. The benefits of data warehousing: why some organizations realize exceptional payoffs. *Information & Management,* 39**,** 491-502.

WATSON, H. J. & WIXOM, B. H. 2007. The current state of business intelligence. *Computer,* 40**,** 96-99.

WATSON, H. J., WIXOM, B. H., HOFFER, J. A., ANDERSON-LEHMAN, R. & REYNOLDS, A. M. 2006. Real-time business intelligence: Best practices at Continental Airlines. *Information systems management,* 23**,** 7-18.

WEE, S. 2000. Juggling toward ERP success: keep key success factors high. *ERP news***,** 1-5.

WEI, C. C., CHIEN, C. F. & WANG, M. J. J. 2005. An AHP-based approach to ERP system selection. *International Journal of Production Economics,* 96**,** 47-62.

WEILL, P. 2004. Don't just lead, govern: How top-performing firms govern IT. *MIS Quarterly Executive,* 3**,** 1-17.

WELLS, J. D., FUERST, W. L. & CHOOBINEH, J. 1999. Managing information technology (IT) for one-to-one customer interaction. *Information & Management,* 35**,** 53-62.

WHITING, R. 2003. Business Intelligence Buck IT Spending Slowdown, TechWeb, viewed on 9th May 2003.

WIGAND, R. T. & BENJAMIN, R. I. 1995. Electronic commerce: Effects on electronic markets. *Journal of Computer‐Mediated Communication,* 1**,** 0-0.

WILLCOCKS, L. P. & PLANT, R. 2001. Getting from bricks to clicks. *MIT Sloan Management Review,* 42**,** 50-60.

WILLCOCKS, L. P. & SYKES, R. 2000. Enterprise resource planning: the role of the CIO and it function in ERP. *Communications of the ACM,* 43**,** 32-38.

WILLER, D. 1967. *Scientific sociology: Theory and method,* Prentice-Hall Englewood Cliffs, NJ.

WILLIAMS, S., WILLIAMS, N. & CONSULTING, D. P. 2003. The business value of business intelligence. *Business Intelligence Journal,* 8**,** 30-39.

WILLIAMS, T. G. 1981. *Consumer behavior: Fundamentals & strategies*, West Pub. Co.

WILSON, R., GAINES, J. & HILL, R. P. 2008. Neuromarketing and consumer free will. *Journal of Consumer Affairs,* 42**,** 389-410.

WINER, R. S. 2001. A framework for customer relationship management. *California Management Review,* 43**,** 89-105.

WISEMAN, C. 1988. Strategic Information Systems: Trends and Challenges over the Next Decade. *Information Management Review,* 4**,** 9-16.

WOOD, T. & CALDAS, M. P. 1999. Reductionism and complex thinking during ERP implementations. *Business Process Management Journal,* 7**,** 387-393.

WORLEY, J. H., CHATHA, K., WESTON, R., AGUIRRE, O. & GRABOT, B. 2005. Implementation and optimisation of ERP systems: A better integration of processes, roles, knowledge and user competencies. *Computers in Industry,* 56**,** 620-638.

WU, J. H. & WANG, Y. M. 2003. Enterprise resource planning experience in Taiwan: an empirical study and comparative analysis.

WU, J. H., WANG, Y. M., CHANG-CHIEN, M. C. & TAI, W. C. Year. An examination of ERP user satisfaction in Taiwan. *In,* 2002. Published by the IEEE Computer Society, 227b.

YEN, D. C., CHOU, D. C. & CHANG, J. 2002. A synergic analysis for web-based enterprise resources planning systems. *Computer Standards & Interfaces,* 24**,** 337-346.

YEN, H. J. R. & SHEU, C. 2004. Aligning ERP implementation with competitive priorities of manufacturing firms: An exploratory study. *International Journal of Production Economics,* 92**,** 207-220.

YIM, C. K. & KANNAN, P. 1999. Consumer Behavioral Loyalty:: A Segmentation Model and Analysis. *Journal of Business Research,* 44**,** 75-92.

YU, Z., YAN, H. & CHENG, T. C. E. 2001. Benefits of information sharing with supply chain partnerships. *Industrial Management & Data Systems,* 101**,** 114-121.

YUSUF, Y., GUNASEKARAN, A. & ABTHORPE, M. S. 2004. Enterprise information systems project implementation::: A case study of ERP in Rolls-Royce. *International Journal of Production Economics,* 87**,** 251-266.

ZABLAH, A. R., DANNY, N. B. & WESLEY, J. J. 2003. Customer relationship management: An explication of its domain and avenues for further inquiry. *Relationship Marketing, Customer Relationship Management and Marketing Management: Co-Operation–Competition–Co-Evolution***,** 115–24.

ZAIRI, M. 1992. *Competitive benchmarking: An executive guide*, Technical Communications (Pub.)(Letchworth, Hertfordshire, England).

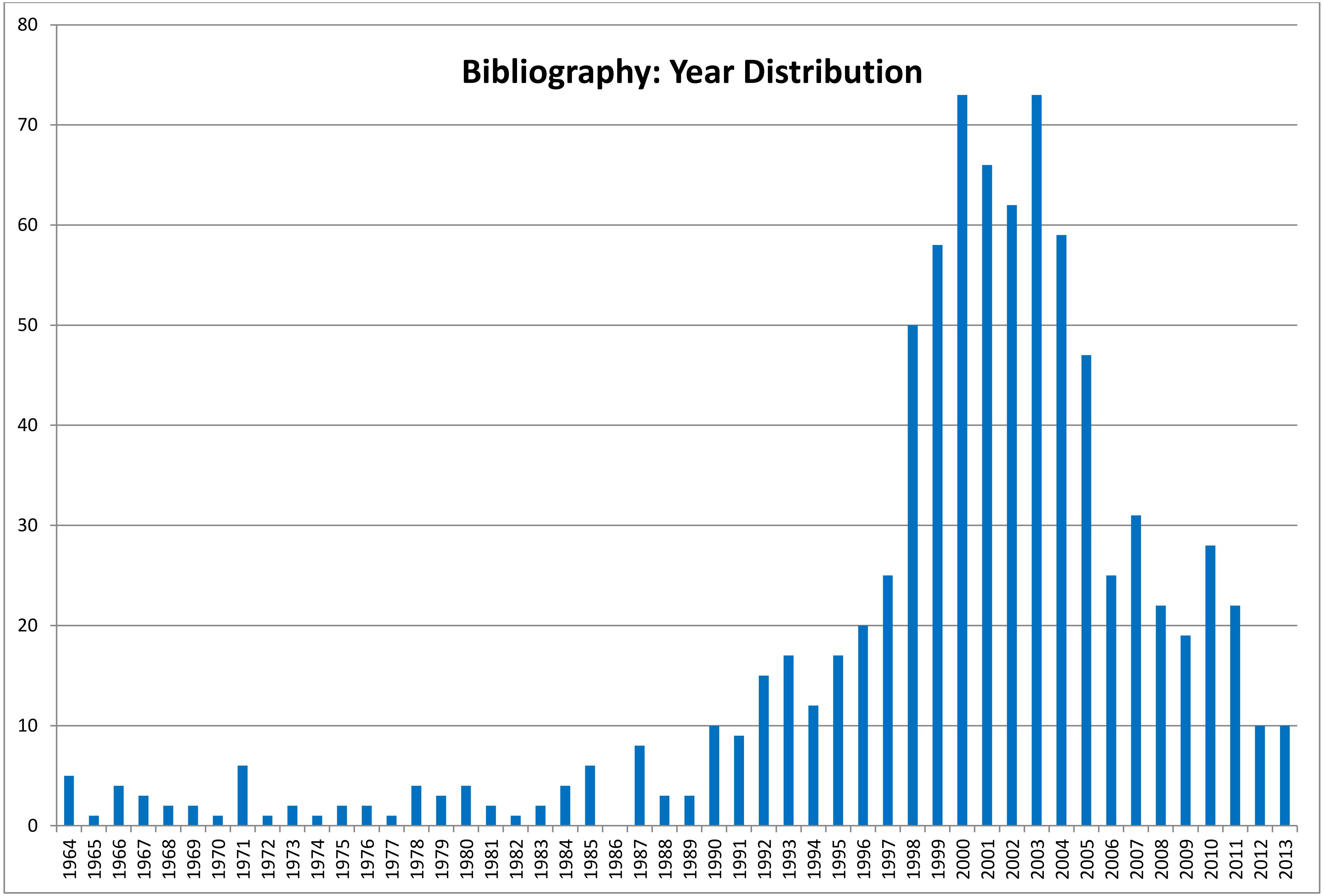
ZAIRI, M. & SINCLAIR, D. 1995. Business process re-engineering and process management: a survey of current practice and future trends in integrated management. *Business Process Management Journal,* 1**,** 8-30.

ZELLWEGER, P. 1997. Web-based sales: defining the cognitive buyer. *Electronic Markets,* 7**,** 10-16.

ZENG, L., XU, L., SHI, Z., WANG, M. & WU, W. Year. Techniques, process, and enterprise solutions of business intelligence. *In,* 2006. IEEE, 4722-4726.

ZHANG, L., LEE, M. K. O., ZHANG, Z. & BANERJEE, P. 2003. Critical success factors of enterprise resource planning systems implementation success in China.

ZWASS, V. 1996. Electronic commerce: structures and issues. *International Journal of Electronic Commerce,* 1**,** 3-23.


Bibliography: Year Distribution
0
10
20
30
40
50
60
70
80
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013

Index

A

B

T

X

Z